REAR AXLE/REAR SUSPENSION/DRIVESHAFT 15

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GENERAL DESCRIPTION

Depending on their equipment, Ford Transit '78 vehicles can be fitted with one of 3 different rear axles, Figs. 1, 2 and 3.

These rear axles are designated 'F', 'G' and 'H' in the following text.

On the 'F' and 'G' axles, the differential is mounted directly in the axle housing, so when repairs are carried out on the rear axle, the rear axle must be removed.

The 'H' axle has a bolt-on differential. So repairs to this differential do not entail removal of the axle.

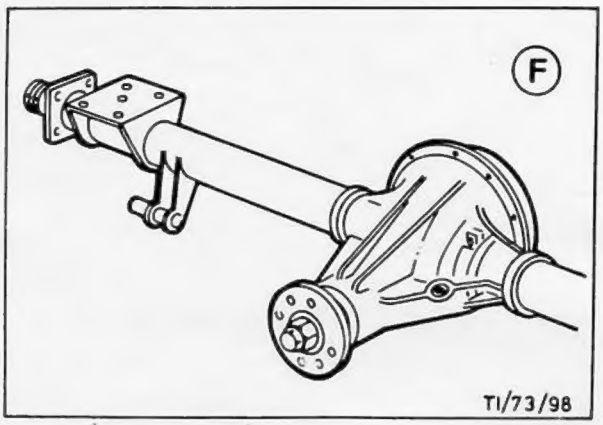


Fig. 1. 'F' axle

Rear Suspension

The rigid rear axle is supended on semi-elliptical leaf springs with telescopic shock-absorbers.

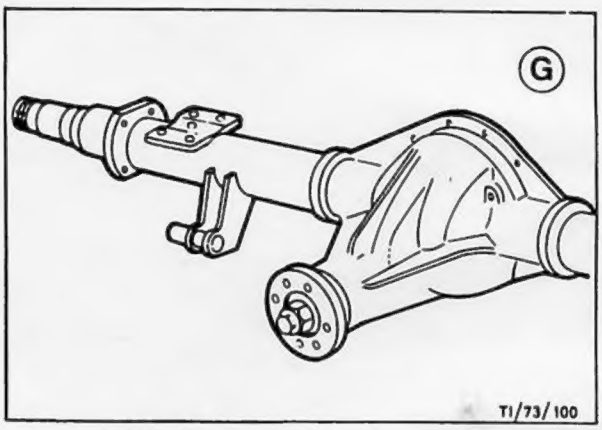


Fig. 2. 'G' axle

Driveshafts

Two part driveshafts are used to transmit torque from the gearbox to the rear axle. The split driveshaft has a centre bearing and a universal joint. The centre bearing is a ball bearing (in a flexible soft rubber mounting) which is secured in a housing on the floor pan. When fitting this driveshaft the installation procedure in operation 15 514 must be followed.

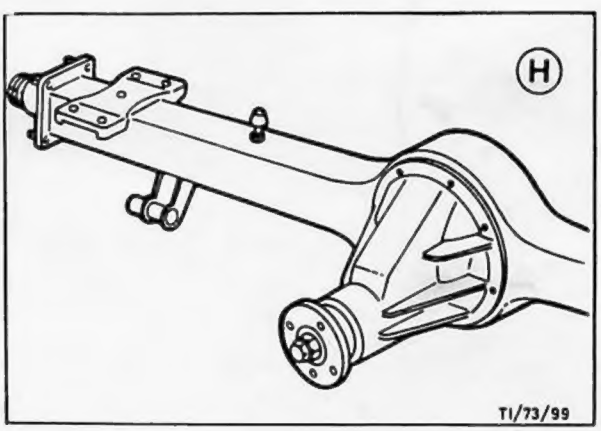


Fig. 3. 'H' axle

REAR AXLE USAGE CHART

Engine	Transm.		Ratios						Vehicle version
					Rear axle				
	man	auto	STD	RPO	G	F	H		
							man	auto	
1,6 ltr Kent (OHV)	X		X			4,63	4,56		FT80 van and kombi
				X		5,14	5,14		
1,6 ltr LC (OHC)	X		X			5,14	5,14		FT100, 120 van and kombi 9 and 12–seater bus
				X		4,63	4,56		FT100, 120 cowl/chassis+single cab FT100, 120 cowl/chassis+dual cab
2,0 ltr LC (OHC)	X	X	X		4,63		4,11		FT100*, 120*† van and kombi FT100L–190 van and kombi FT130B kombi 9 and 12–seat bus*†
				X	5,14		4,44	4,44	15–seat bus
				X	5,83		4,56	4,44	FT100*, 120*† cowl/chassis+ single cab
				X			5,14	HD	FT100L–190 cowl/chassis+single cab FT100*, 120*† cowl/chassis+dual cab FT130, 190 cowl/chassis+dual cab
2,4 ltr Diesel (OHV)	X	X			5,83		4,11		FT100, 120 van and kombi
				X	4,63		4,44		FT100L–190 van and kombi 9 and 12–seat bus, 15–seat bus
				X	5,14				FT100, 120 cowl/chassis+single cab FT100L–190 cowl/chassis+single cab FT100, 120 cowl/chassis+dual cab FT130, 190 cowl/chassis+dual cab

* automatic transmission optional

† uprated H axle with ratio of 4,44 HD in conjunction with 2,0 ltr LC (OHC) engine and automatic transmission

PRINCIPLE OF OPERATION

(a) **Drive Pinion**

In all three axles the drive pinion runs in 2 taper roller bearings. The bearings are held in position:

1. By a clamping sleeve on the 'F' and 'H' axles.
2. By a spacer sleeve on the 'G' axle, the dimensions of which are established as indicated in operation 15 214 8.

The correct depth of mesh of the drive pinion in the crown wheel is set by means of suitable shims between the head of the drive pinion and the taper roller bearing.

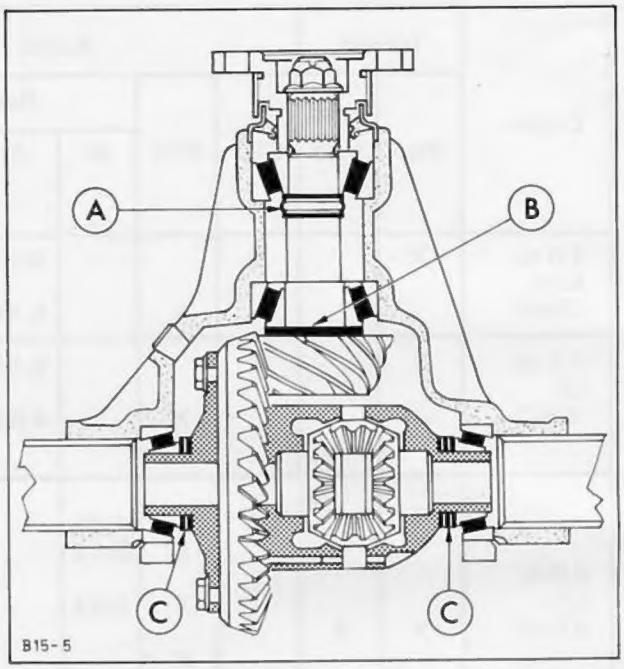


Fig. 4. 'F' axle
A – Clamping sleeve
B – Drive pinion shim
C – Differential housing shims

(b) **Half-shaft Taper Roller Bearings**

The half-shaft taper roller bearings are preloaded:

1. By shims between axle casing and differential on the 'F' axle.
2. By ring nuts on the axle casing on the 'G' axle.
3. By ring nuts in the differential housing on the 'H' axle.

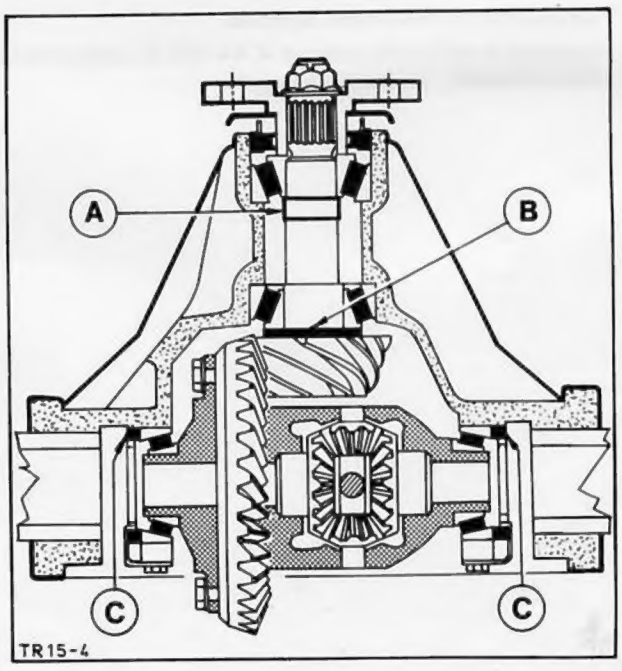


Fig. 5. 'G' axle
A – Spacer sleeve
B – Drive pinion shim
C – Ring nuts

(c) **Power Flow**

1. In the 'F' and 'H' axles the power flows via 2 or via 4 differential gears and 2 half-shaft gears (side gears).

2. In the 'G' axle power flow is basically via 4 differential gears and 2 half-shaft gears (side gears).

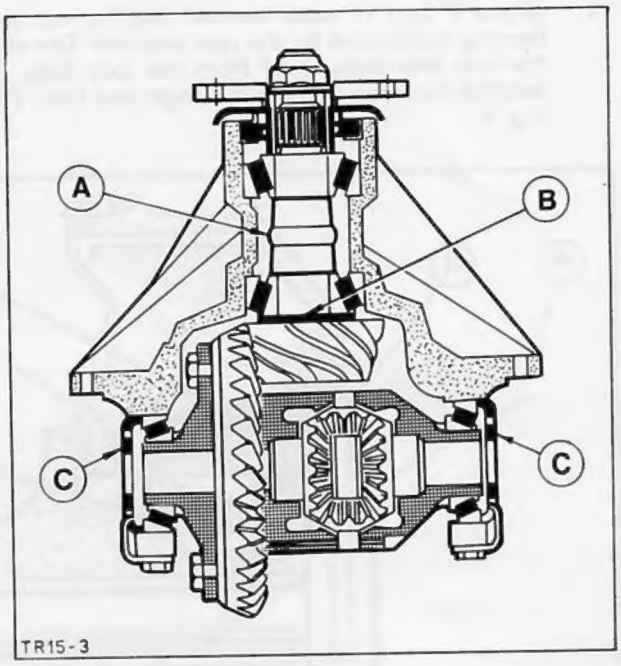


Fig. 6. 'H' axle
A – Clamping sleeve
B – Drive pinion shim
C – Ring nuts

(d) **Half-Shafts**

In all three axles the half-shafts are splined to the side gears. Differences exist only in the wheel-hub mountings which are the same only in the 'F' and 'H' axles.

1. IN the 'F' and 'H' axles the half-shaft drives the wheel-hub which is mounted on the axle tube in a ball bearing (lubricated by the rear axle oil). The assembly is sealed by means of a sealing ring which sits in the hub and seals it off from the axle tube. The half-shaft is also sealed off at the hub by a gasket located between half-shaft flange and hub. The bearing is held in position by means of a spacer ring, Fig. 7.

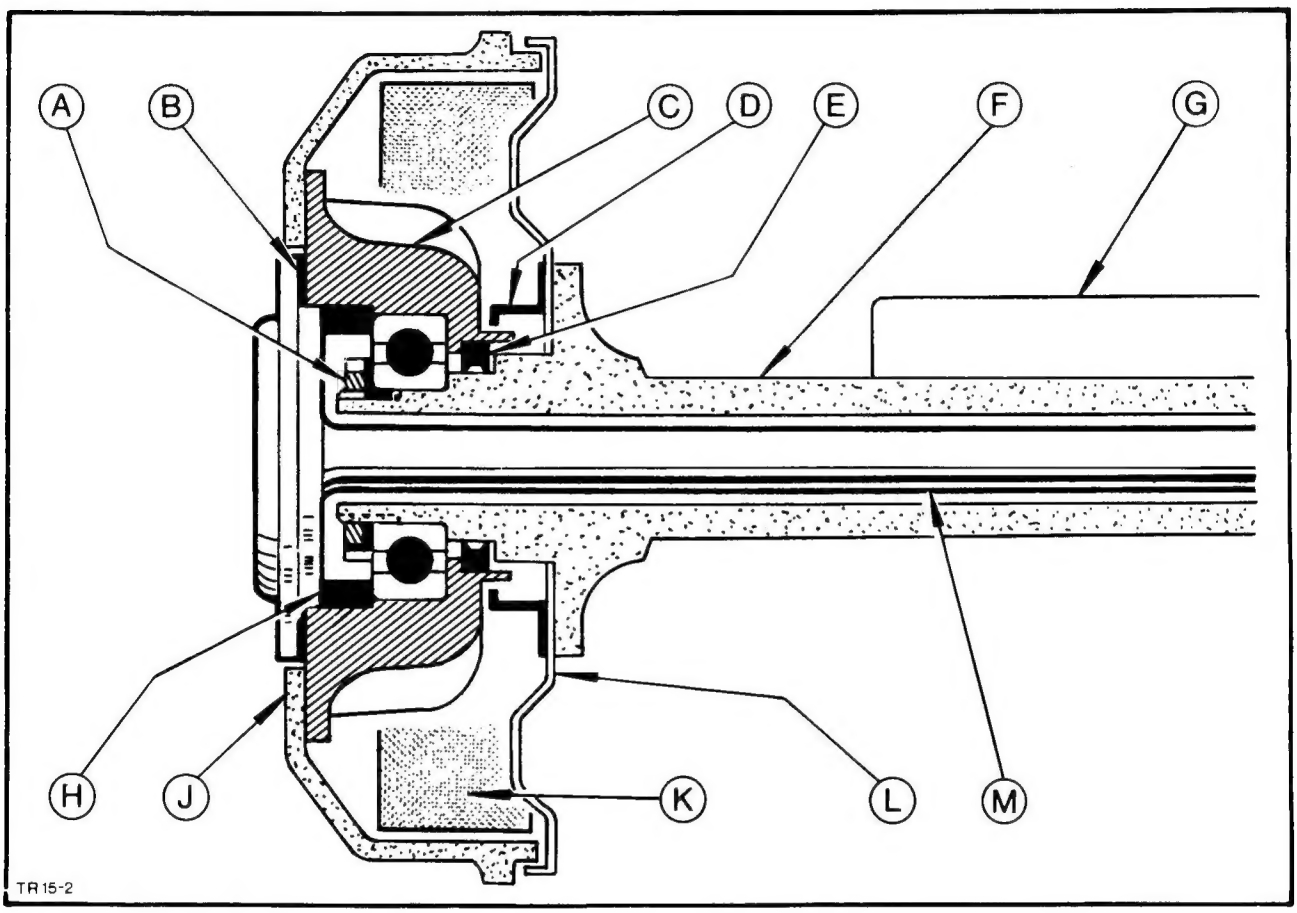


Fig. 7. Hub – 'F' and 'H' axles

A – Nut
B – Gasket half-shaft/hub
C – Hub
D – Gaurd
E – Oil seal axle-tube/hub
F – Axle tube
G – Spring bearer
H – Spacer ring
J – Brake drum
K – Brake
L – Brake carrier plate
M – Half-shaft

2. On the 'G' axle the wheel-hub is mounted on the axle tube with two taper roller bearings. These taper roller bearings are lubricated by the rear axle oil. The axle-tube/hub sealing is effected by an oil seal located in front of the inner bearing. Another seal is located between the half-shaft flange and the wheel-hub. Here the bearing play is set with locknuts, Fig. 8.

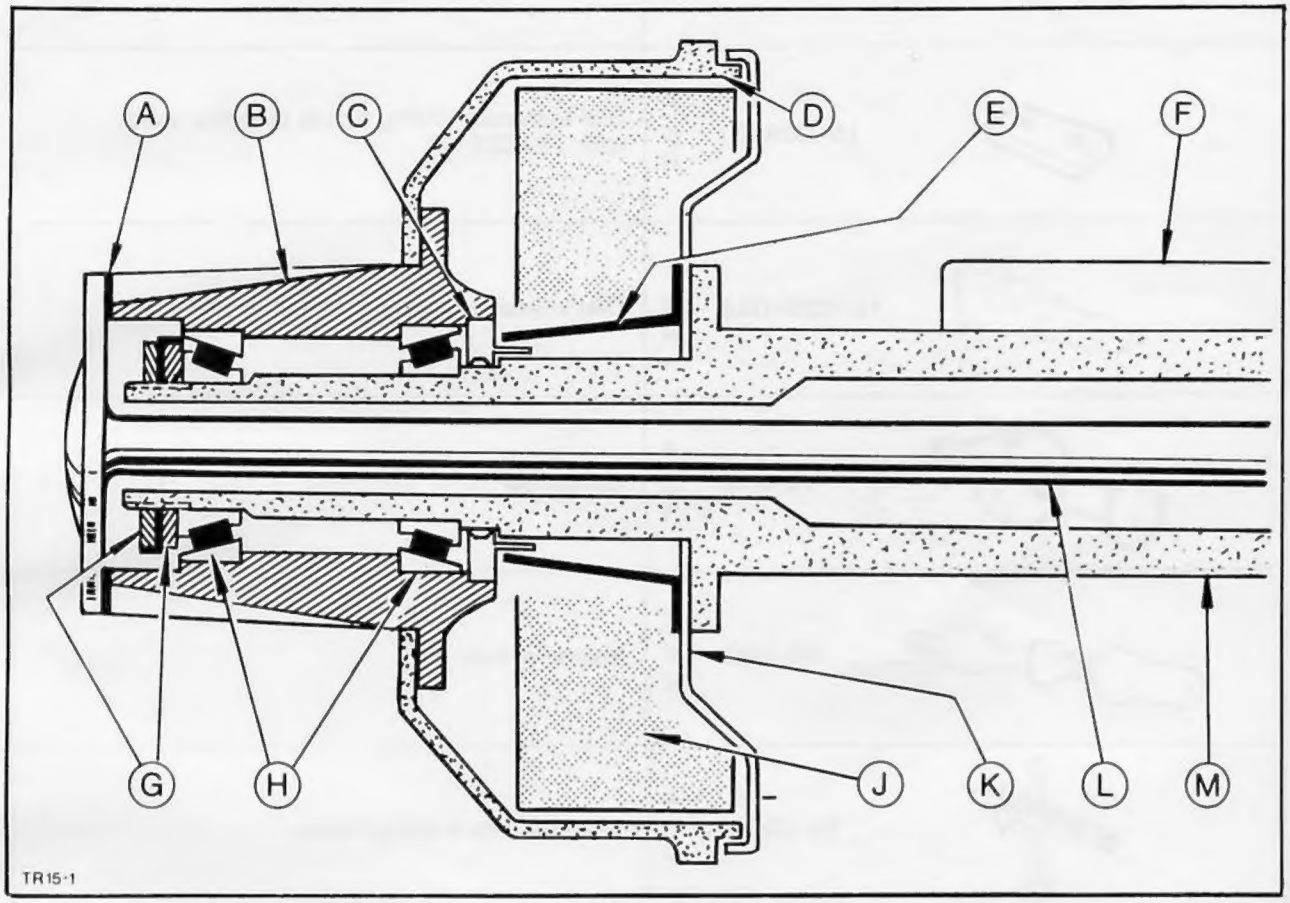


Fig. 8. Wheel-hub – 'G' axle

A – Gasket half-shaft/hub
B – Hub
C – Seal axle-tube/hub
D – Brake drum
E – Gaurd
F – Spring bearer
G – Locknuts
H – Taper roller bearing
J – Brake
K – Brake carrier plate
L – Half-shaft
M – Axle tube

SERVICE ADJUSTMENTS AND CHECKS

To check the oil level in the rear axle, the vehicle must be standing on level ground. Oil level should be up to the lower edge of the filler opening, Fig. 9. Top up with specified oil (see Technical Data) if necessary.

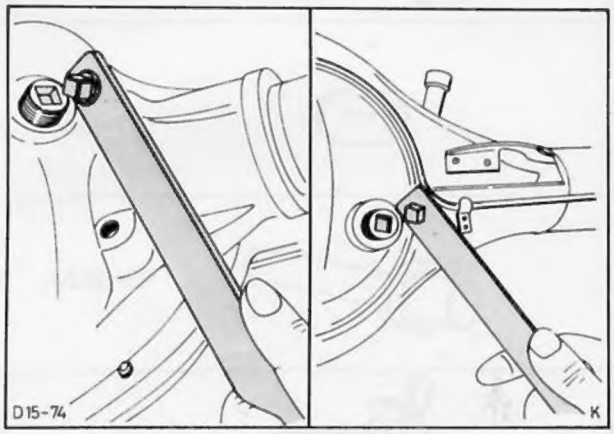
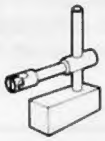
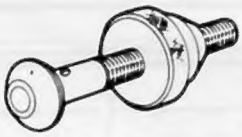
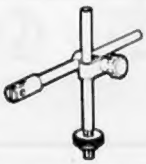
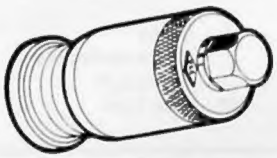
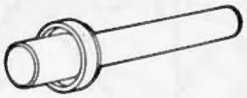
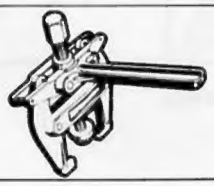
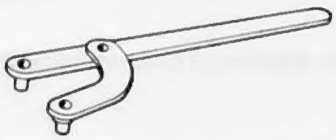
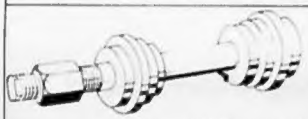
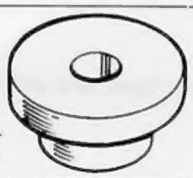
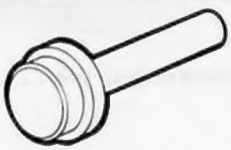
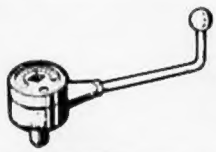


Fig. 9. Check oil level in rear axle

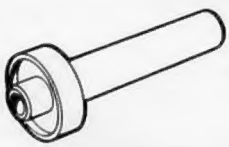
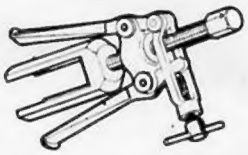
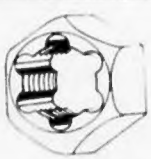
SPECIAL SERVICE TOOL RECOGNITION

	15–008	F G H	Dial indicator mounting block
	15–008–01	F G H	Dial indicator holding fixture (adaptor used with 15–022–A)
	15–008–03B	F G H	Dial indicator setting gauge
	15–019	F G H	Gauge bar
	15–020	G F H	Master pinion
	15–022A	F G H	Dial indicator holding fixture
	15–023	F G H	Pre-load sleeve
	15–024	G	Master spacer
	15–025A	F H	Differential bearing cone installer
	15–026A	F G H	Differential bearing cone remover

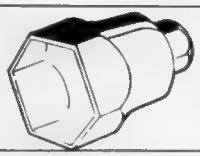
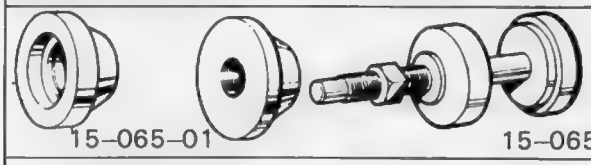
SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	15–026–51	G	Adaptor for 15–026
	15–027	G	Differential bearing adjusting nut wrench
	15–028	G	Rear hub nut wrench
	15–029	F H	Rear hub nut wrench
	15–030	F G H	Universal flange holding wrench
	15–033	F H	Pinion bearing cup installer
  15–035 and 15–064 15–065 and 15–065–01		G	Pinion bearing cup installer (main tool and adaptor)
	15–036	F	Rear hub grease seal installer adaptor (use with 550 handle)
	15–037	G	Differential bearing installer adaptor (use with 550 handle)
	15–041	F G H	Pre-load gauge

SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	15–042 F H	Pinion bearing installer
	15–046 F G H	Metric dial indicator gauge
	15–047B F G H	Pinion oil seal installer
	15–048 F G H	Pinion oil seal remover
	15–049 F	Pressure spindle differential bearing adjustment
	15–049–01 F	Pressure pads (use with 15–049)
15–059 and 15–059–01 15–054	F H	Taper base and pinion bearing remover adaptor
	15–057 F G	Rear axle mounting bracket (use with 21–023)
	15–060 F	Rear hub remover
	15–061 F	Axle die nut

SPECIAL SERVICE TOOL RECOGNITION (cont'd)

 15–062 G	Rear hub nut wrench
15–059 15–059–08 15–063 G	Pinion bearing remover/installer
 15–065–01 15–065 G	Pinion bearing cup installer and adaptor
16–009 H	Rear axle mounting bracket
21–023A F G H	Universal spindle (only in conjunction with stand)

SERVICE AND REPAIR OPERATIONS – CONTENT

REAR AXLE/REAR SUSPENSION/DRIVESHAFT		Described for axle			Also applicable to following models		
		F	G	H	Escort	Taunus/ Cortina	Capri
15 212	Rear axle and suspension assembly – remove and install	X	X	X	—	—	—
15 214	Rear axle assembly – remove and install	X	X	X	—	—	—
15 214 8	Rear axle assembly – overhaul	X	X	X	X	X	X
15 254	Differential assembly – remove and install	—	—	X	X	—	X
15 254 8	Differential assembly – overhaul	—	—	X	X	—	X
15 302	Seal – drive pinion – replace	X	X	X	X	X	X
15 514	Driveshaft assembly – remove and install	X	X	X	—	—	—
15 564 4	Centre bearing – driveshaft – replace	X	X	X	X	X	X
15 621	Rear spring assembly – remove and install	X	X	X	—	—	—

SERVICE AND REPAIR OPERATIONS

15 212 REAR AXLE AND SUSPENSION ASSEMBLY – REMOVE AND INSTALL

Special Service Tools Required: None

To Remove

1. Jack-up vehicle at rear and fit stands under side members. Leave jack under rear axle.
2. Detach driveshaft from drive pinion flange.
3. Detach brake pipes from brake hoses and unhook spring of load-conscious brake valve at the top, Fig. 10.

   When spring is detached at the bottom, the load-conscious brake valve must be adjusted as in operation 12 136 after assembly.

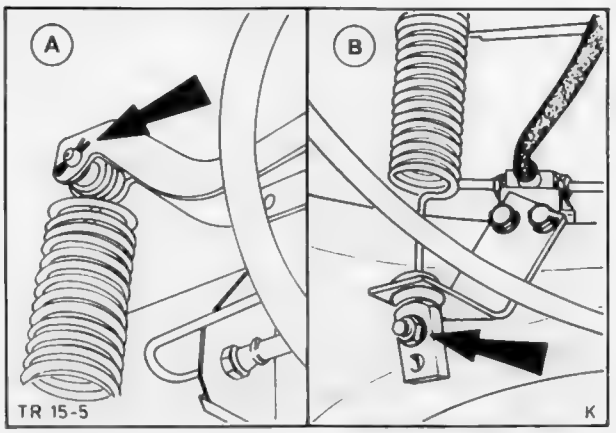


Fig. 10. Unhook spring of load-conscious brake valve
A – Unhook at top
B – Unhook at bottom

4. Detach exhaust from body at the rear.
5. Detach handbrake cable from linkage, body and bracket, Fig. 11 (1 bolt, 2 clips and 2 screws).
6. Detach shock absorbers from body on left and right hand sides (1 bolt each).

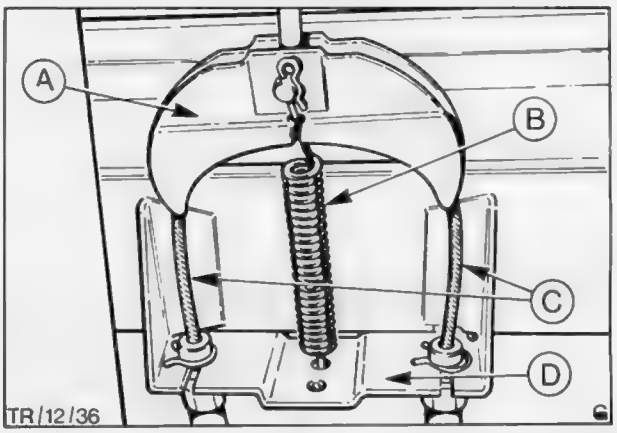


Fig. 11. A – Balancing yoke
B – Return spring
C – Handbrake cables
D – Support bracket

7. Detach rear springs from body at front and rear mountings on left and right hand sides (4 bolts), Fig. 12.
8. Take out rear axle and suspension assembly complete using the jack.

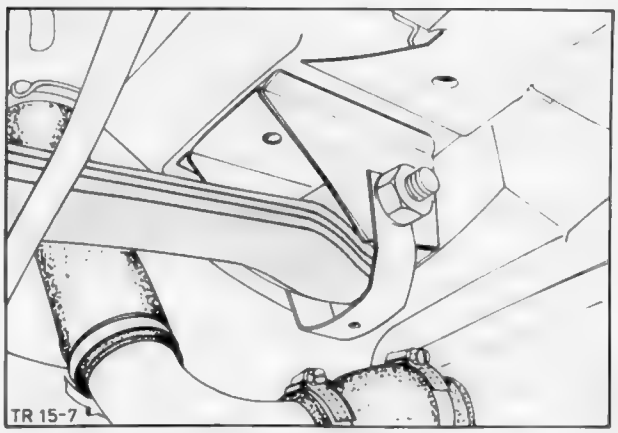


Fig. 12. Detach rear springs from body

To Install

9. Locate complete rear axle assembly in position, Fig. 13.
10. Bolt rear springs in place in following order front left, front right, rear left and rear right.

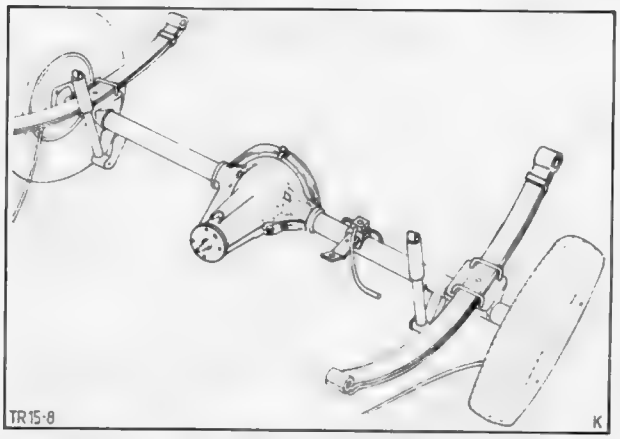


Fig. 13. Locate complete rear axle assembly

11. Fix right and left shock absorbers to body, Fig. 14.
12. Attach handbrake cable to linkage, body and bracket and adjust.
13. Attach exhaust to body at rear.
14. Connect spring of load-conscious brake valve and attach brake pipe to brake hose.

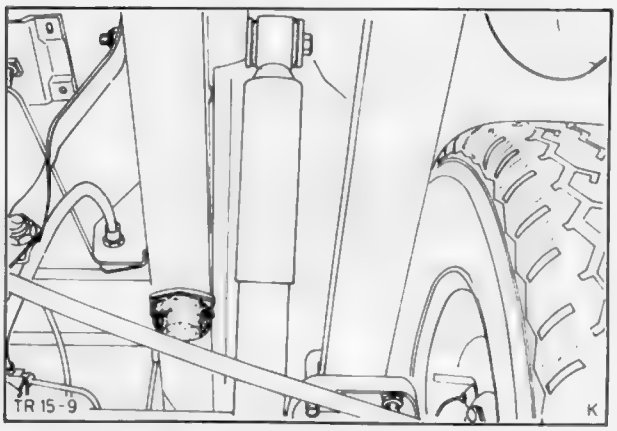


Fig. 14. Fix shock absorbers to body

15. Bolt driveshaft to drive pinion flange, Fig. 15.
16. Bleed rear brake circuit.

NOTE: All rear spring mountings must only be tightened with suspension under load.

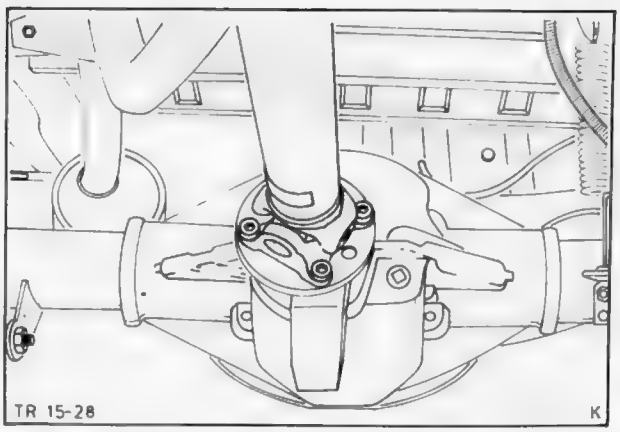


Fig. 15. Attach driveshaft to drive pinion flange

15 214 REAR AXLE ASSEMBLY – REMOVE AND INSTALL

Special Service Tools Required:

Rear hub remover	15–060
Rear hub nut wrench	15–028
Rear hub nut wrench	15–026
Rear hub nut wrench	15–062

To Remove

1. Slacken wheel nuts, remove left and right hand axle shafts, Fig. 16 (6 nuts or 5 bolts in each case).

   NOTE: On the 'H' axle remove or install brake drums before axle shafts.

2. Jack up vehicle and fit stands under side members, detach wheels and brake drums.

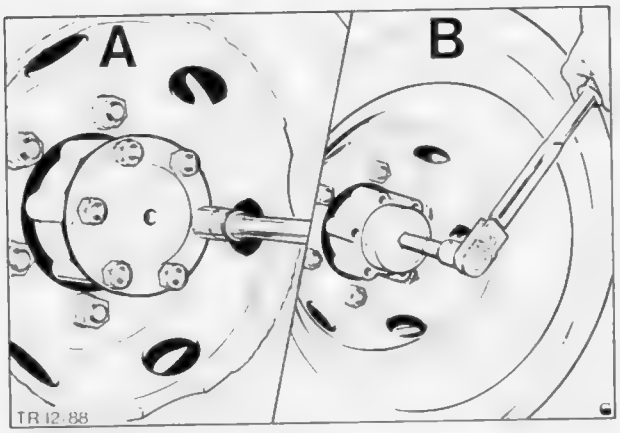


Fig. 16. A – Unscrew axle shaft nuts
B – Undo locknut with special tool no. 15–029

   NOTE: On the 'G' axle remove brake drums with wheel hub.

3. Remove wheel hubs using Special Tool No. 15–060 after releasing locknuts, Fig. 17.

   NOTE: Plug axle tubes with rag.

4. Detach brake pipes from brake hoses, wheel cylinder and rear axle.

5. Detach handbrake cable at rear from linkage and body (1 bolt and 2 clips).

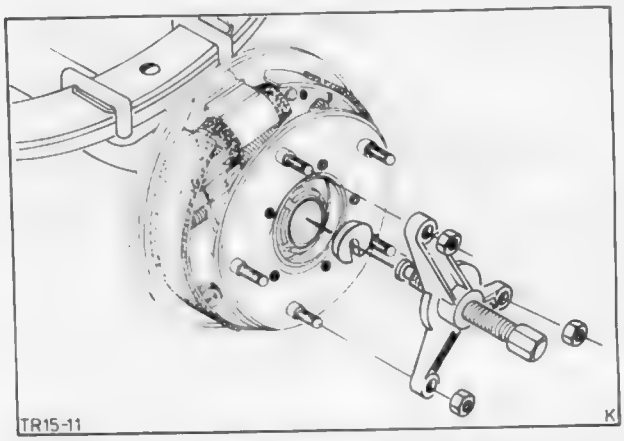


Fig. 17. Remove hub with special tool no. 15–060
('F' axle shown)

6. Remove brake carriers on right and left hand sides, Fig. 18 (4 nuts each on 'F' and 'H' axles and 6 nuts each on 'G' axle).

7. Disconnect driveshaft from drive pinion flange (4 bolts).

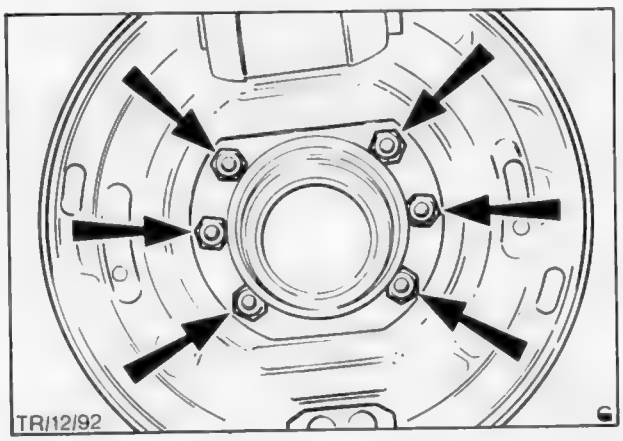


Fig. 18. Detach brake carrier plate ('G' axle shown)

8. Detach both shock absorbers from the rear axle (1 bolt each).
9. Remove spring U-bolts on left and right hand sides (4 nuts in each case), Fig. 19.
10. Take out rear axle.

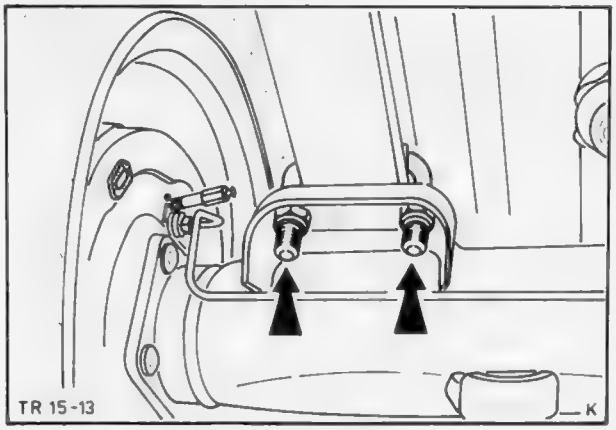


Fig. 19. Remove U-bolts

To Install

11. Locate rear axle in position and centre axle with the centering bolts, Fig. 20.
12. Attach U-bolts with retaining plate on right and left hand sides.
13. Secure both shock absorbers to the rear axle.

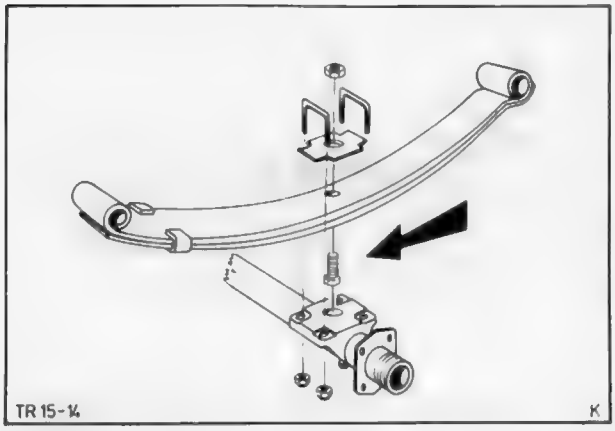


Fig. 20. Centre axle with centering bolts

14. Fix driveshaft to drive pinion flange, Fig. 21.
15. Attach brake carriers on right and left hand sides.
16. Connect brake pipes to wheel cylinder and rear axle and attach brake pipe to brake hose.

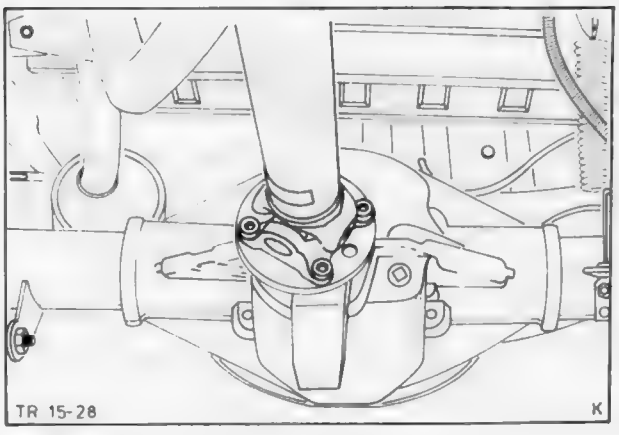


Fig. 21. Fix driveshaft to drive pinion flange

15 214 (cont'd)

17. Fit wheel hubs, torquing nuts as specified with Special Tool No. 15–029 for 'F' and 'H' axles, and tool 15–028 (67 mm) or 15–062 (65 mm) for the 'G' axle, Fig. 22.

    NOTE: On the 'G' axle, fit brakes drums with hub.

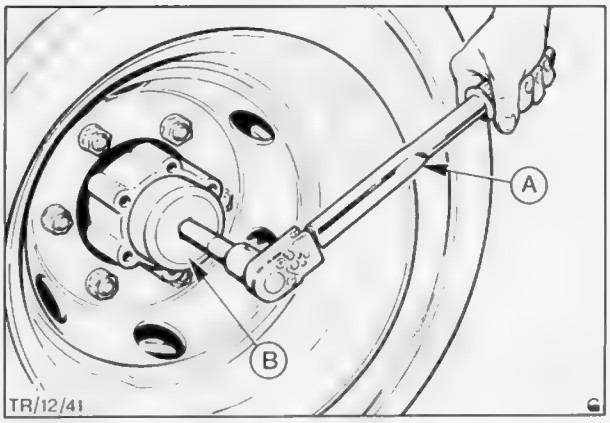


Fig. 22. Tighten nuts with special tool
A – Torque wrench
B – Special tool no. 15–029 ('G' axle shown)

18. Fit brake drums.
19. Remove rag plugs, attach handbrake cable at rear to linkage and body, Fig. 23, adjust and bleed rear brake circuit.
20. Fit wheels, install left and right hand-shafts.
21. Take vehicle off stands and tighten wheel nuts and fill axle with specified oil.

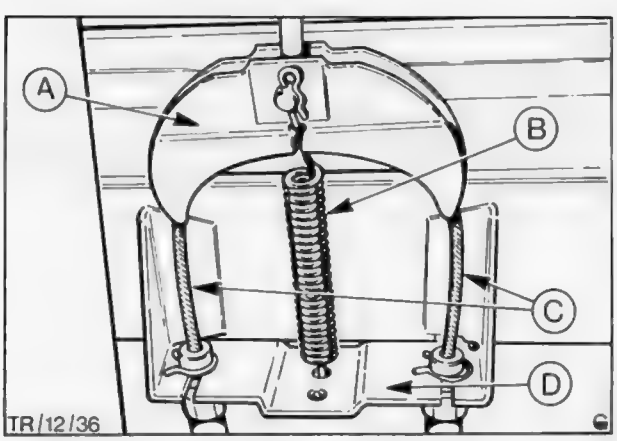


Fig. 23. A – Balancing yoke
B – Return spring
C – Handbrake cables
D – Support bracket

15 214 8 REAR AXLE ASSEMBLY – OVERHAUL

Special Service Tools Required:

Dial indicator mounting block	15–008
Adaptor for dial indicator holding fixture 15–022–A	15–008–01
Dial Indicator setting gauge	15–008–03B
Gauge bar	15–019
Master pinion	15–020
Dial indicator holding fixture	15–022A
Pre-load sleeve	15–023
Differential bearing cone installer	15–025A
Differential bearing cone remover	15–026
Adaptor for 15–026	15–026–51
Rear hub nut wrench (67 mm)	15–028
Universal flange holding wrench	15–030
Differential bearing installer	15–037
Metric dial indicator	15–046
Drive pinion oil seal installer	15–047B
Rear axle mounting bracket (only in conjunction with 21–023)	15–057
Rear hub nut wrench (65 mm)	15–062
Drive pinion remover	15–063
Pinion bearing cup installer	15–065
Adaptor for 15–065	15–065–01
Universal shaft – only in conjuntion with stand	21–023

To Dismantle Rear Axle

1. Mount rear axle on stand, Fig. 24, and detach rear axle casing cover (12 bolts).
2. Pivot axle and drain oil.
3. Detach locking plates from bearing cap, Fig. 25.
4. Undo differential (4 bolts) and take differential gear train with adjusting nuts from axle casing.
5. Remove drive pinion (1 nut). To do this, hold flange with Special Tool and undo nut, Fig. 26, tap drive pinion out downwards with a copper hammer. Detach flange.
6. Press oil seal and outer taper roller bearing out of housing simultaneously with a suitable tube. Detach inner taper roller bearing from drive pinion using Special Tool No. 15–063.

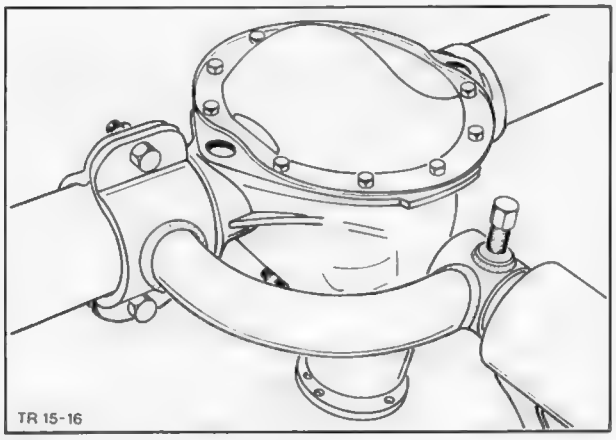


Fig. 24. Mount rear axle on stand
'F' + 'G' axle mounting stand 15–057
'H' axle mounting stand 16–009
Use in conjunction with 21–023

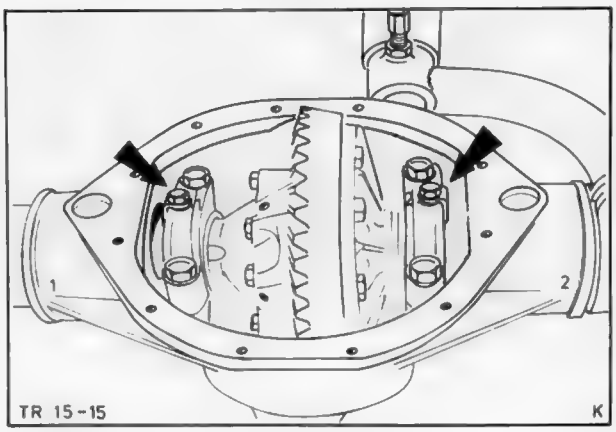


Fig. 25. Detach lock plates from bearing cap

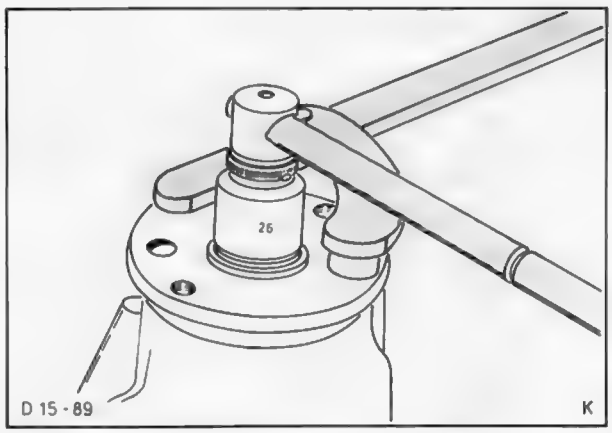


Fig. 26. Hold flange with special tool no. 15–030

To Dismantle Differential

7. Detach differential taper roller bearing from differential housing. To do this, clamp one leg of Special Tool in a vice and pull off bearing, Fig. 27.

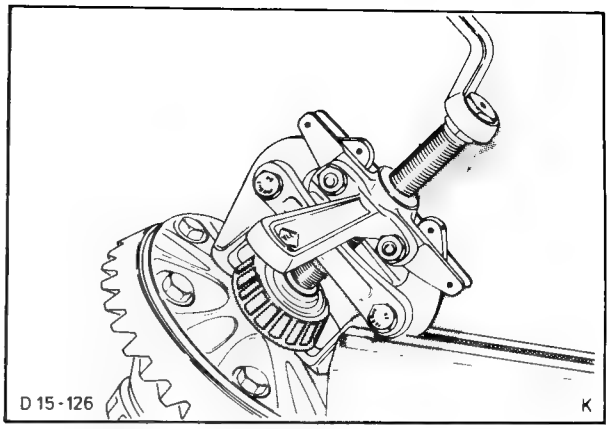


Fig. 27. Clamp special tool in vice by one leg and detach bearing

8. Detach crown wheel from differential housing, Fig. 28 (10 bolts). To do this, slacken 3 bolts spaced out over the periphery (remove the remainder completely) so that the crown wheel can be removed by tapping the bolt heads.

9. Take differential gears and side gears out of differential housing (8 bolts), detach differential housing half, lift out differential gears with differential cross and side gears. Remove shims.

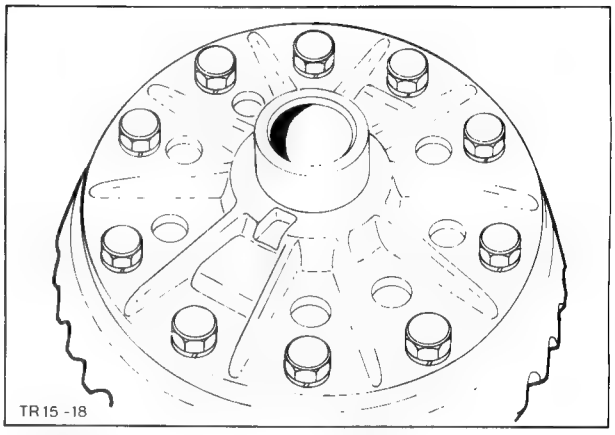


Fig. 28. Detach crown wheel from differential housing

To Reassemble Differential

10. Install differential gears and side gears in differential housing, inserting side gears with shims and differential gears with thrust washers and differential cross in housing halves in reverse order, Fig. 29.

    Assemble differential housing halves.

    NOTE: Coat bolts with 'Loctite' before insertion. Grooved side of shims must face side gear. Align marks on housing halves.

    When using new shims, check side gears run easily with a half-shaft.

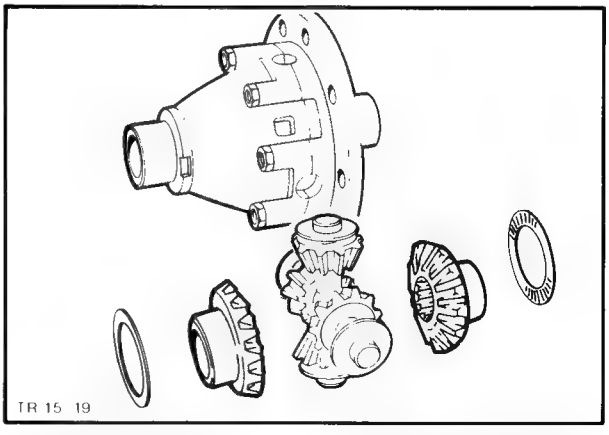


Fig. 29. Remove differential gears with differential cross and side gears

11. Attach crown wheel (10 bolts), secure crown wheel to differential housing evenly.

    NOTE: Use new bolts and spring washers, heat crown wheel before fitting.

12. Remove and re-install outer bearing cup of drive pinion taper roller bearing with Special Tool, Fig. 30.

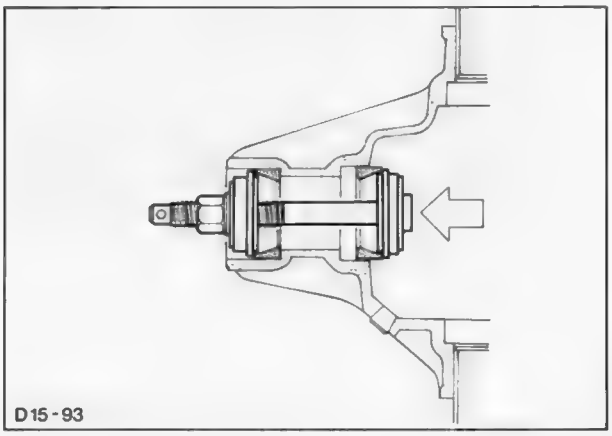


Fig. 30. Remove outer drive pinion bearing cup with special tool no. 15–035 15–064

13. Remove and re-install inner bearing cup of drive pinion taper roller bearing with Special Tool No. 15–065 15–065–01.

    NOTE: Only replace one bearing cup at a time as one cup always provides support for the installation tool.

Determine Thickness of Drive Pinion Shim

14. Slide shim that has been removed or a new shim of any thickness onto master pinion with inner taper roller bearing, Fig. 31.

    NOTE: Moisten taper roller bearing with rear axle oil and secure with the conical nut.

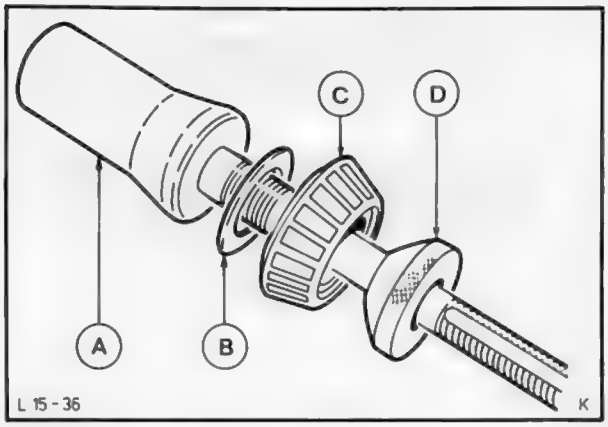


Fig. 31. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

15. Insert master pinion in axle casing, fit outer bearing and handle, screw on pre-load sleeve. Grasp handle of master pinion firmly and turn hexagonal end of pre-load sleeve clockwise, in the case of new bearings until the outer bell of the tool lines up on the A mark (use B mark for used bearings), Fig. 32.

    Rotate the master pinion several times so that the bearings are correctly seated.

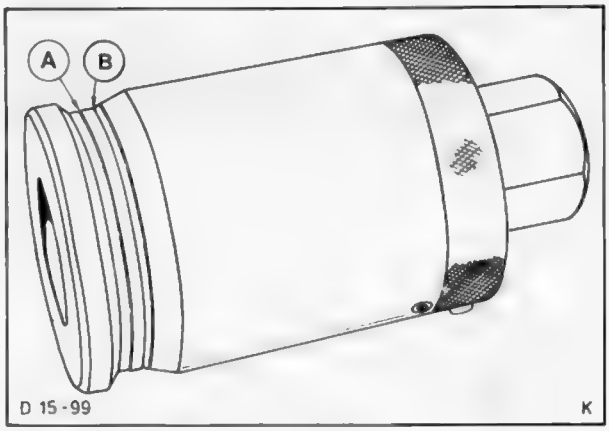


Fig. 32. Pre-load sleeve 15–023
A – Mark for new bearings
B – Mark for used bearings

15 214 8 (cont'd) 'G' AXLE

16. Establish the torque needed to turn unit with pre-load gauge 15–041 and note value, Fig. 33.
NOTE: This torque reading **must** be maintained when drive pinion is installed. If reading is 2,3 Nm (23 cmkp) for instance, reading must be the same (+0,3 Nm (+3 cmkp) for friction of oil seal) when drive pinion has been fitted.

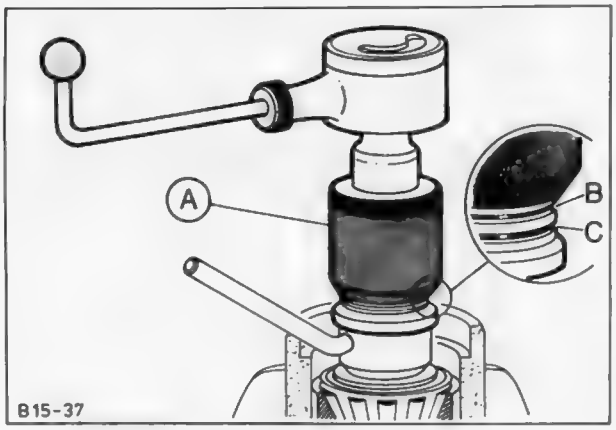


Fig. 33. Pre-load sleeve 15–023
A – Pre-load sleeve
B – Mark for used bearing
C – Mark for new bearing

17. Insert gauge bar with bearings to be fitted and adjusting nuts in casing, Fig. 34. Fit bearing cap (numbers coincide) and secure to specified torque, slacken again and do up finger-tight.
NOTE: Do up adjusting nuts finger-tight so that they bear on the bearing cups. Oil bearings and fit.

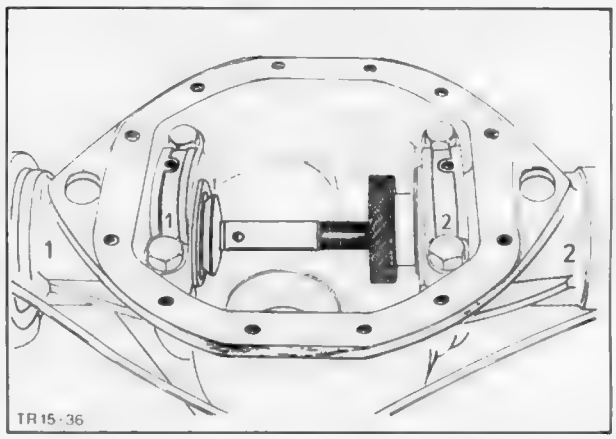


Fig. 34. Gauge bar located in rear axle casing

18. Hold gauge bar still with a suitable mandrel, Fig. 35, and turn adjusting nuts outwards until gauge bar can just be turned by hand at adjusting nut (after removing mandrel). Rotate gauge bar several times to settle bearings.

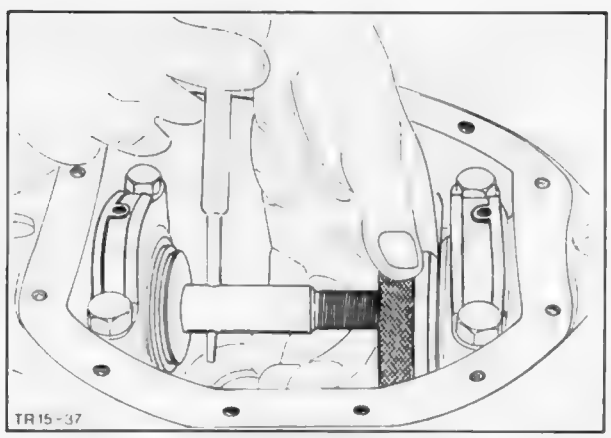


Fig. 35. Set up gauge bar

19. Secure dial indicator with holding fixture on rear axle casing and position plunger on centre of gauge bar. Turn bar slowly and observe total deflection of dial pointer, Fig. 36. Then turn gauge bar until dial indicator reading is half the deflection measured. Gauge bar must not be turned any more.

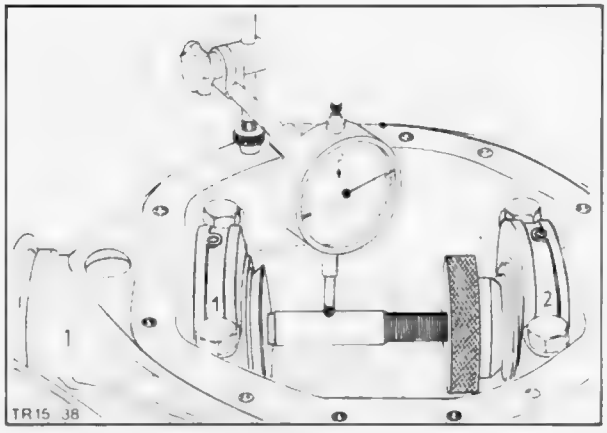


Fig. 36. Adjust gauge bar 15–019

20. Set up master pinion. To do this, locate dial indicator on outer edge of master pinion end close to the gauge bar. Rotate master pinion slowly through one full turn and observe total deflection of dial pointer, Fig. 37. Then continue turning master pinion until dial indicator reading is half the total deflection measured. Master pinion must not be turned any more after this operation.

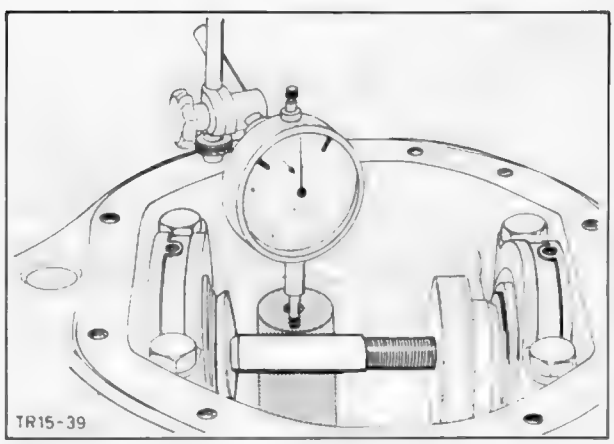


Fig. 37. Adjust master pinion

21. Remove dial indicator from holding fixture and mount in block. Locate mounting block with dial indicator on a ground surface and zero with the aid of the setting gauge as shown, Fig. 38.

NOTE: The rear axle code letters are engraved on the step gauge below the individual steps, e.g. 'A+E'. The dial indicator must be zeroed on 'G' step of the step gauge before measuring a 'G' rear axle.

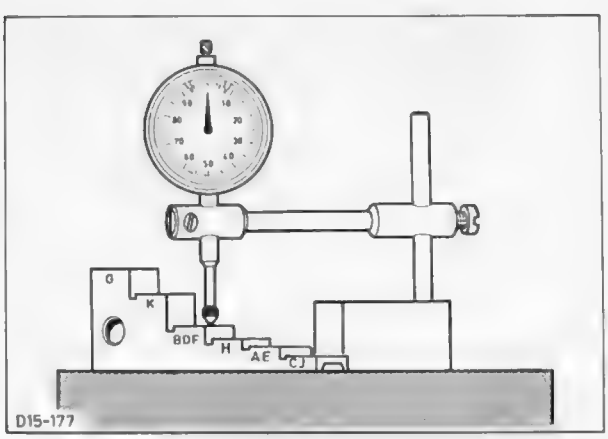


Fig. 38. Zero dial indicator

22. Place mounting block with dial indicator on the middle of the end of the master pinion and move plunger of indicator slowly across the gauge bar. Observe dial indicator and stop at the precise point where the pointer changes direction. Repeat this measuring operation several times and ensure maximum precision, Figs. 39/40.

NOTE: If indicator pointer reads 95 for example, the shim under the master pinion is 0,05 mm too thick. If the pointer changes direction at 4 for instance, the shim is 0,04 mm too thin. (This assumes a dial indicator in which the pointer moves clockwise when the plunger is pressed in).

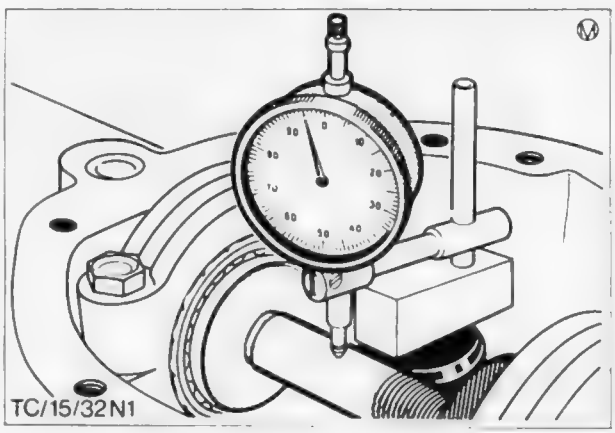


Fig. 39. Indicator reading 95 – shim under master pinion too thick

Example

Thickness of shim under master pinion	1,75 mm
Indicator pointer to left of 'O', e.g. 95	–0,05 mm
	1,70 mm

This is the thickness of shim that must be provided between taper roller bearing and top of drive pinion.

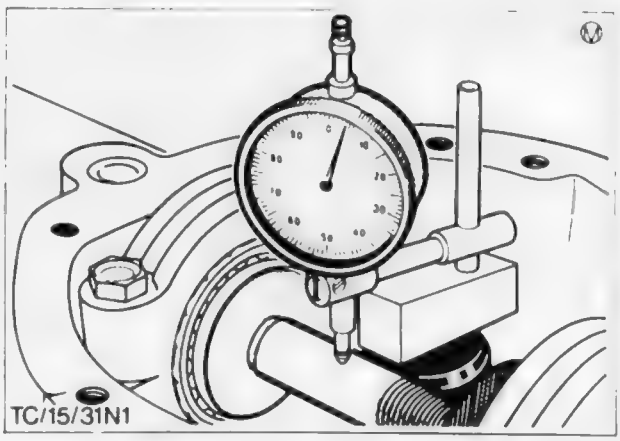


Fig. 40. Indicator reading 4 – shim under master pinion too thin

23. Remove master pinion and take off taper roller bearing and shim, Fig. 41. Establish new shim from measurement. Measure shim with micrometer to match value determined (see Parts Catalogue for shim part numbers).

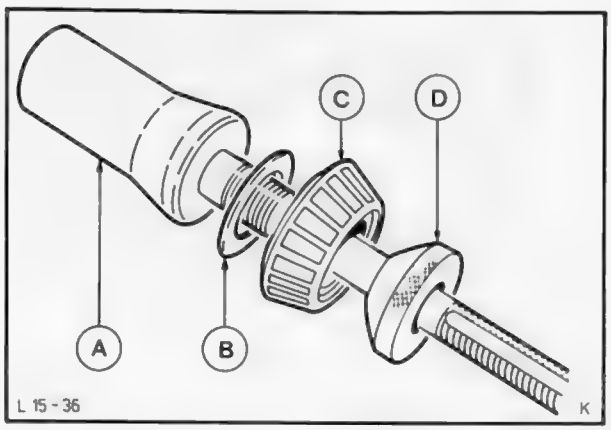


Fig. 41. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

24. Slip chosen shim onto master pinion and screw up conical nut.

25. Fit master pinion as specified in sub-operation 17.

26. Set up master pinion as indicated in sub-operation 20.

27. Re-check zero of dial indicator in mounting block with aid of setting gauge and place block on the end of the master pinion. If plunger of dial indicator is moved across the gauge bar as beforehand (in sub-operation 22), indicator must read 'O' if the preceding measurements were accurate, Fig. 42. Discrepancies of a maximum of 0,01 mm from 'O' are permissible.

    If however deviation from 'O' is more, the measuring operation must be repeated as described and a new shim must be found.

    Repeat checking operation.

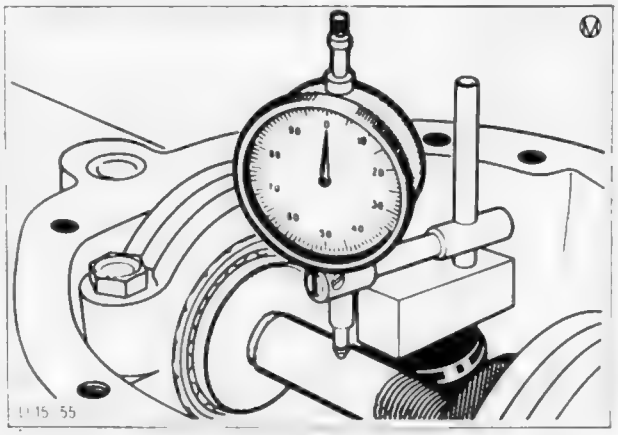


Fig. 42. Dial indicator at 'O' (max. discrepancy 0,01 mm)

28. Remove master pinion and gauge bar. Detach taper roller bearing and chosen shim from master pinion.

    NOTE: After removal, taper roller bearing and differential bearing cup must not be located on the other side.

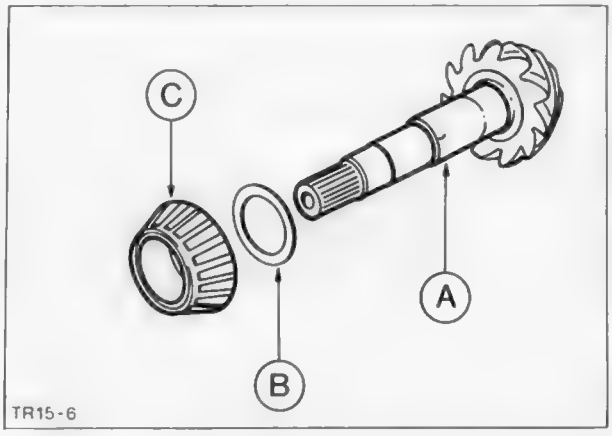


Fig. 43. Press taper roller bearing and chosen shim onto drive pinion
A – Drive pinion
B – Shim
C – Taper roller bearing

29. Press taper roller bearing and chosen shim onto drive pinion, Fig. 43.

30. Fit both differential housing taper roller bearings with Special Tool No., Fig. 44.

    NOTE: Fit first taper roller bearing to crown wheel rear side of differential housing.

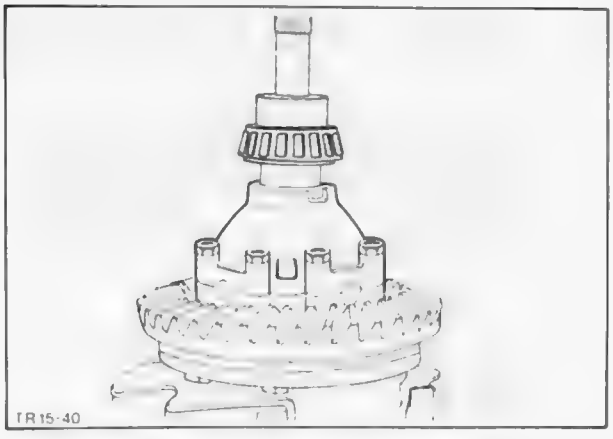


Fig. 44. Press on taper roller bearing with special tool no. 15–031

To Determine Length of Drive Pinion Spacer and Install

31. Slip gauge ring over drive pinion. Bend 2 mm diameter soldering wire into a ring of the same diameter as the drive pinion shaft and place it on the Master spacer, Fig. 45.

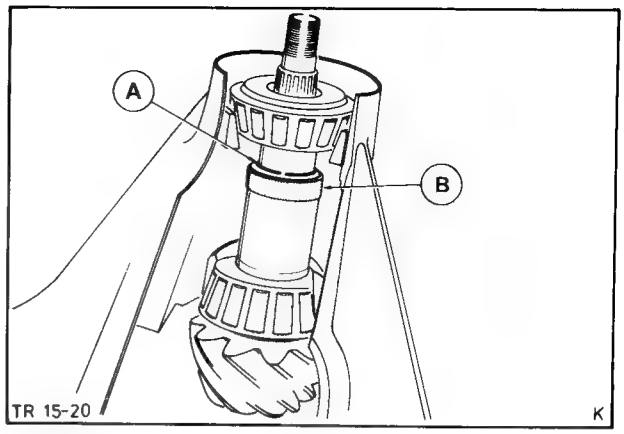


Fig. 45. Determine length of spacer
A – Ring of soldering wire
B – Master spacer 15–024

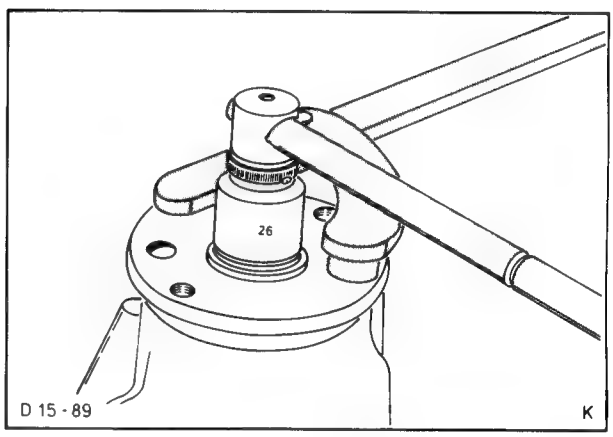


Fig. 46. Hold drive pinion flange and tighten nut slowly

32. Locate drive pinion in axle casing. Fit taper roller bearing and drive pinion flange. Screw on the old self-locking nut kept from the dismantling operation. Hold drive pinion flange with flange-holding wrench and tighten nut slowly, Fig. 46. Keep constant check on drive pinion running torque with pre-load gauge. Do up nut until same torque is reached as that noted at the start when adjusting the master pinion (e.g. 2,3 Nm), Fig. 47.

NOTE: If this torque is exceeded, the described operation must be repeated with a new piece of soldering wire.

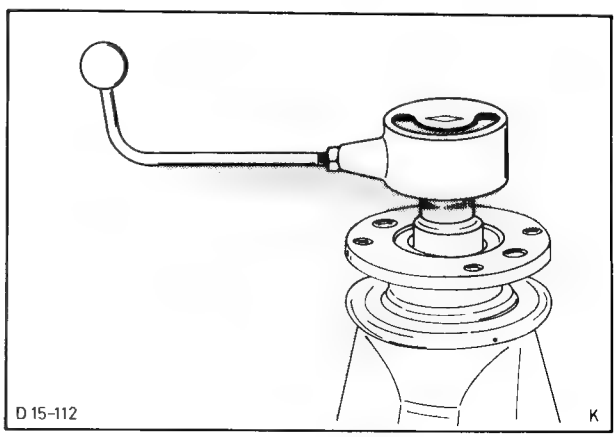


Fig. 47. Check turning torque of drive pinion

33. Remove drive pinion and carefully detach compressed soldering wire from pinion and measure its thickness at two opposing points, Fig. 48. If the values differ, add the two figures together and divide by two. Add this value (e.g. 1,21 mm) to the height of the gauge ring (9,5 mm) giving 9,5+1,21 = 10,71 mm in this example. Choose from the available spacers (see Parts Catalogue) a ring of this size.

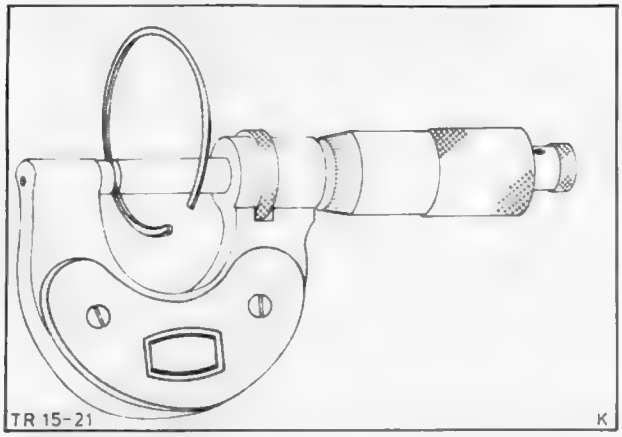


Fig. 48. Measure thickness of compressed soldering wire

34. **Check:** Drive pinion torque. To this end, assemble drive pinion with chosen spacer, taper roller bearing, drive pinion flange and old self-locking nut, Fig. 49. Tighten nut to specified torque.

Rotate drive pinion several times then check turning torque with pre-load gauge. (with this drive pinion 2,3 Nm (23 cmkp) for example). If this torque is exceeded or not reached, a narrower or wider spacer must be selected and the torque then checked again.

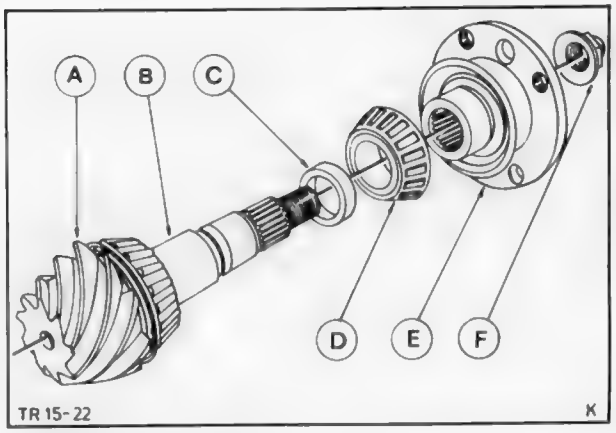


Fig. 49. Assemble complete drive pinion
A – Taper roller bearing
B – Pinion
C – Spacer
D – Taper roller bearing
E – Pinion flange
F – Pinion retaining nut

35. Detach drive pinion flange and fit new seal with Special Tool No. 15–047, Fig. 50. Grease on seal as supplied must not be removed.

36. Attach drive pinion flange and tighten new self-locking nut to specified torque.

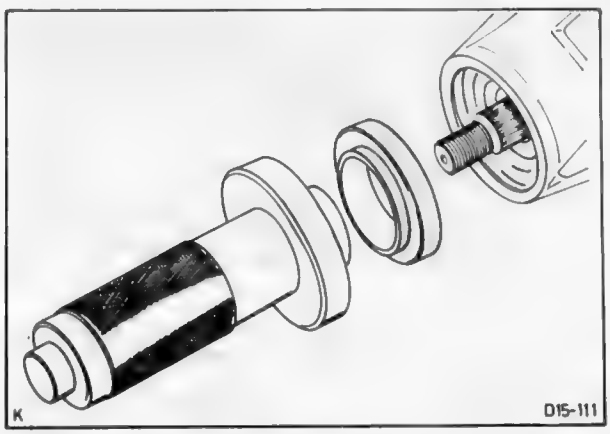


Fig. 50. Press on oil seal with special tool no. 15–047

37. Fit shim in axle casing. Insert differential with both adjusting nuts. Fit bearing caps, secure, slacken and then do up finger-tight, Fig. 51.

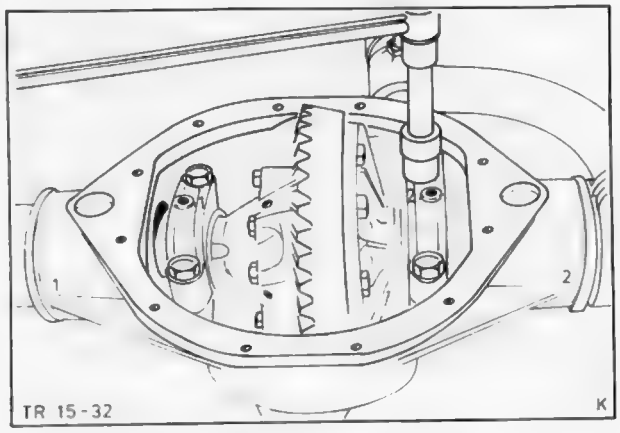


Fig. 51. Fit bearing caps (numbers match) and torque bolts as specified

NOTE: Adjusting nuts must bear on bearing cups.

38. Set backlash. To do this, locate plunger of dial indicator at right angles on one of the crown wheel teeth, Fig. 52. Tighten adjusting nuts on crown wheel side and slacken nut on differential housing side such that backlash value of 0,01 mm is attained. Tighten adjusting nut on differential housing side to give the specified backlash value of 0,12—0,22 mm. Rotate gear several times and recheck backlash measurement at three points.

Tighten bearing cap bolts. Backlash discrepancies must not exceed 0,01 mm.

If backlash has to be corrected, the adjusting nuts must only be turned evenly by the same amount so as to preserve the pre-load on the bearings.

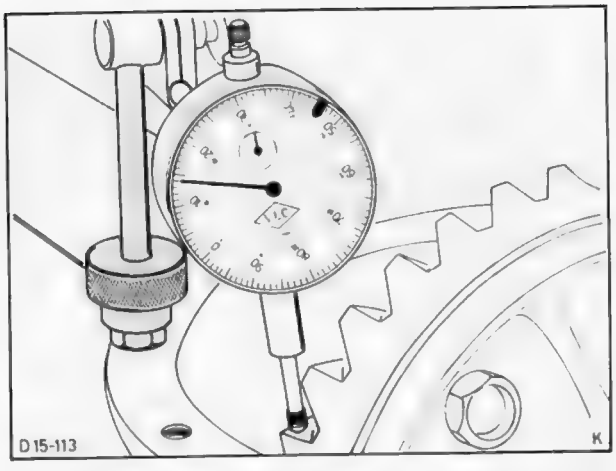


Fig. 52. Locate plunger of dial indicator at right angles on one of crown wheel teeth

39. Check tooth pattern: New crown wheels will still show optimum tooth pattern marks left by testing in the factory, Fig. 53.

    Coat teeth of crown wheel with marker. Place wrench on nut of drive pinion flange and turn drive pinion until all the teeth have been in mesh. In the process, apply a hardwood wedge to the outer edge of the crown wheel to produce a braking effect, Fig. 54.

    As backlash has great influence on tooth pattern, an unsatisfactory tooth pattern can only be rectified by increasing or reducing the backlash within the specified tolerances.

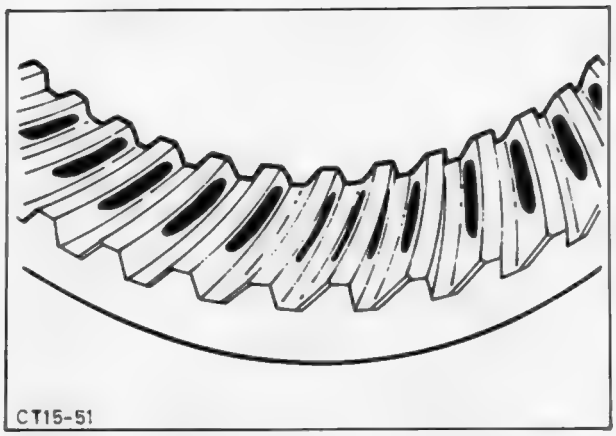


Fig. 53. Optimum tooth pattern

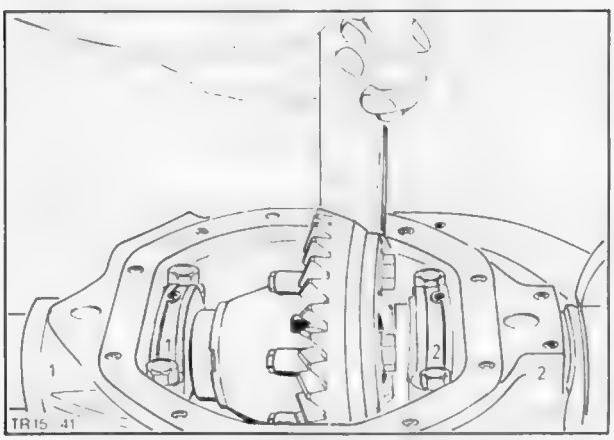


Fig. 54. Brake crown wheel with a hardwood wedge

40. Attach lock plates (2) to ring nuts, Fig. 55. Fit cover to rear axle casing and bolt securely.

    NOTE: Coat bolts with sealing compound before insertion.

41. Detach rear axle from stand.

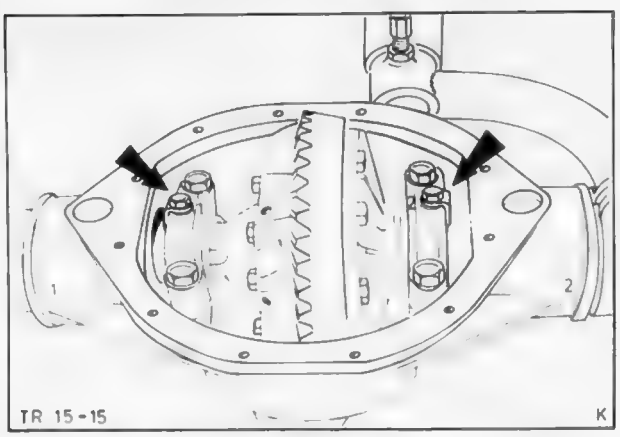


Fig. 55. Attach lock plates to ring nuts

15 214 8 REAR AXLE ASSEMBLY – OVERHAUL

Special Service Tools Required:

Dial indicator mounting block	15–008
Adaptor for dial indicator holding fixture 15–002–A	15–008–01
Dial Indicator setting gauge	15–008–03B
Gauge bar	15–019
Master pinion	15–020
Dial indicator holding fixture	15–022A
Pre-load sleeve	15–023
Differential bearing cone installer	15–025A
Differential bearing cone remover	15–026A
Rear hub nut wrench	15–029
Universal flange holding wrench	15–030
Axle casing bearing cup installer	15–033
Pre-load gauge	15–041
Pinion bearing installer	15–042
Metric dial indicator	15–046
Drive pinion oil seal installer	15–047B
Differential bearing adjusting spindle	15–049
Adaptors for 15–049	15–049–01
Drive pinion remover	15–054
Rear axle mounting bracket (only in conjunction with 21–023)	15–057
Rear hub remover	15–060
Axle die nut	15–061
Universal shaft—only in conjunction with stand	21–023

To Dismantle Rear Axle

1. Mount rear axle on stand, Fig. 56, and remove axle casing cover (10 bolts).
2. Pivot axle and drain oil.
3. Remove differential—to do this, detach both bearing caps (4 bolts) and lift differential out of axle casing with two pointed square section pieces of wood, Fig. 57.
4. Remove drive pinion (1 nut). Hold flange with Special Tool No. 15–030 and unscrew nut, Fig. 58. Tap out drive pinion downwards with a copper hammer and detach flange.

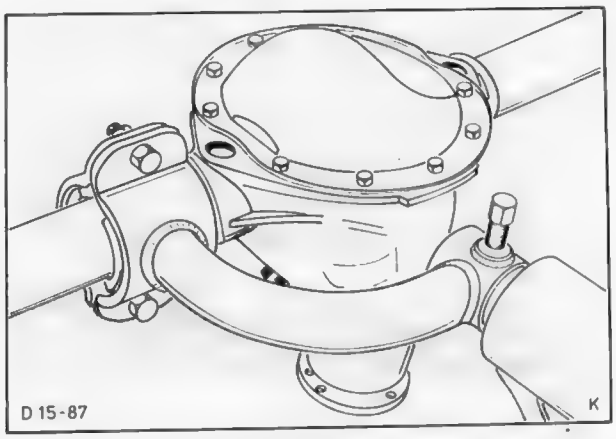


Fig. 56. Rear axle in mounting bracket 15–057 on stand

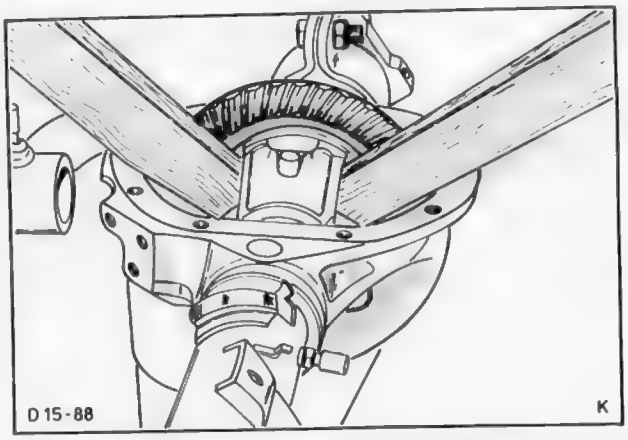


Fig. 57. Lift out differential with two hardwood wedges

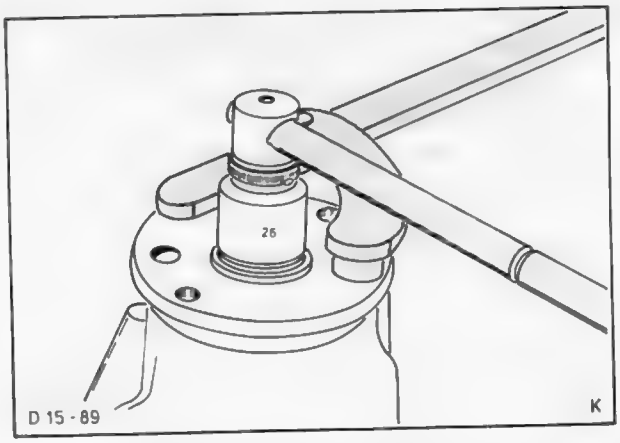


Fig. 58. Hold drive pinion flange with special tool no. 15–030

5. Press oil seal and outer taper roller bearing out of casing simultaneously with the Special Tool, Fig. 59.
6. Pull inner taper roller bearing from drive pinion with Special Tool.

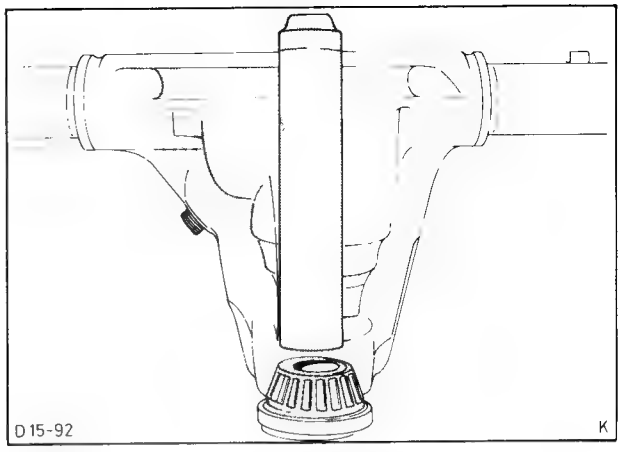


Fig. 59. Press out small taper roller bearing and oil seal

To Dismantle Differential Assembly

7. Remove taper roller bearings from both sides of differential housing with the Special Tool, Fig. 60. To do this, clamp Special Tool in vice by one leg and pull off bearings.

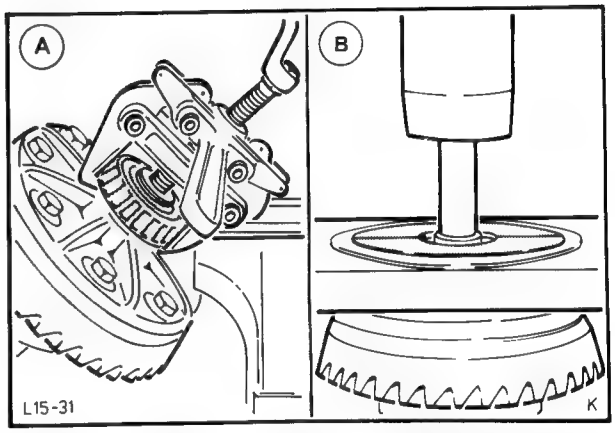


Fig. 60. Remove taper roller bearings from differential housing
A – Special Tool 15–026A
B – Alternative method using press

8. Detach crown wheel from differential housing (8 bolts), Fig. 61. To do this, slacken 3 bolts spaced around the periphery (remove the others completely) so that crown wheel can be removed by tapping bolt heads.

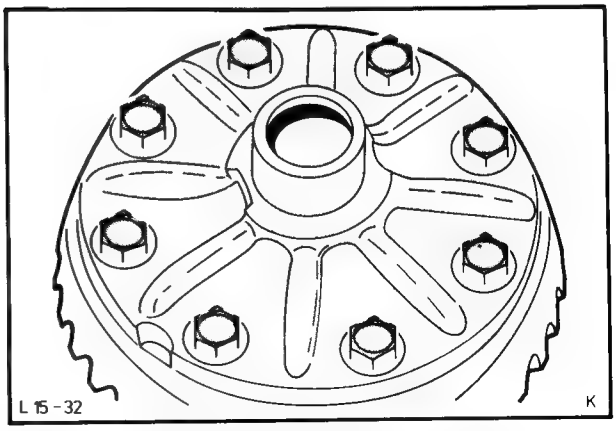


Fig. 61. Crown wheel mounting on differential housing

15 214 8 (cont'd)

9. Measure play between side gear bearing faces and differential housing using a feeler gauge, Fig. 62.

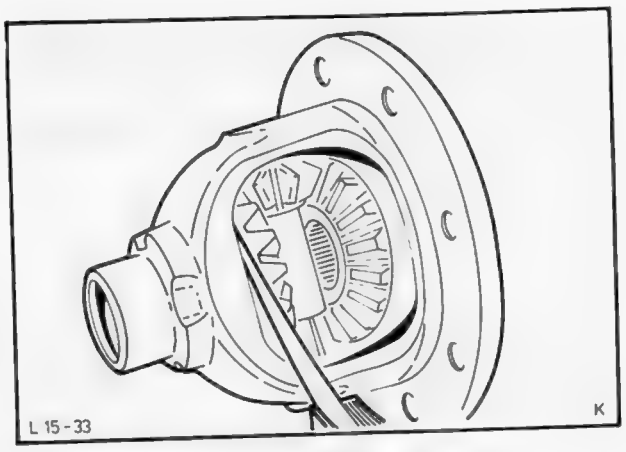


Fig. 62. Measure side gear play with feeler gauge

NOTE: Check play before removing differential gears. Play must not exceed 0,15 mm max.
If necessary, use new washers (see Parts Catalogue).

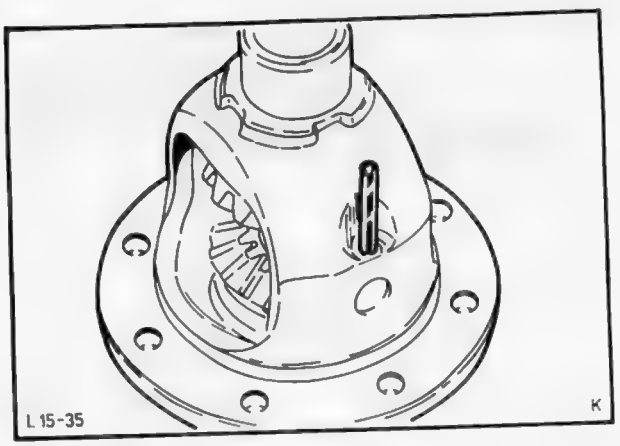


Fig. 63. Roll pin of differential shaft

10. Remove differential gears and side gears from differential housing, Fig. 64. With a suitable drift, force out roll pin securing differential shaft or cross in the differential housing, Fig. 63.

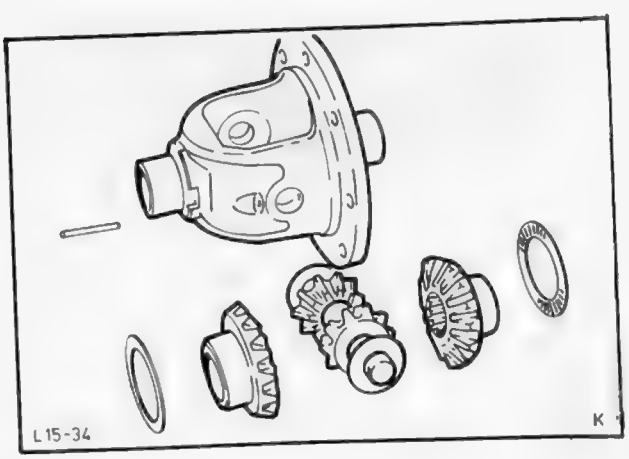


Fig. 64. Differential exploded

To Reassemble Differential

11. Install differential gears and side gears in differential housing. Insert side gears in the housing with the chosen shims. At the same time bring differential gears with thrust washers into mesh between side gears and slide in differential shaft or cross. Secure shaft with roll pin.

    NOTE: Grooved side of shims must face side gear, Fig. 65. When using new shims, re-check play as described in sub-operation 9.

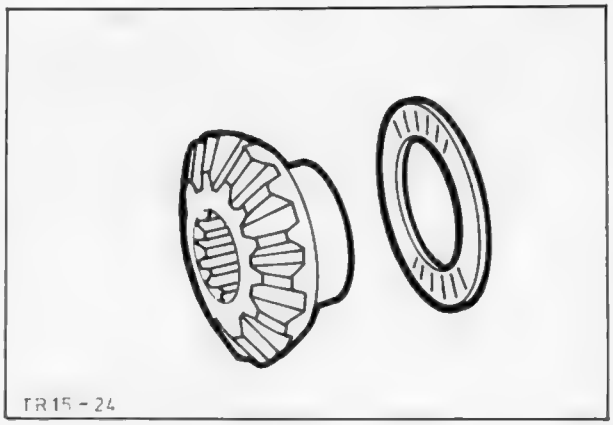


Fig. 65. Grooved side of shim must face side gear

12. Fit crown wheel (8 bolts) ensuring that crown wheel is bolted down evenly on differential housing, Fig. 66.

13. Remove and install outer cup of drive pinion taper roller bearing with Special Tool.

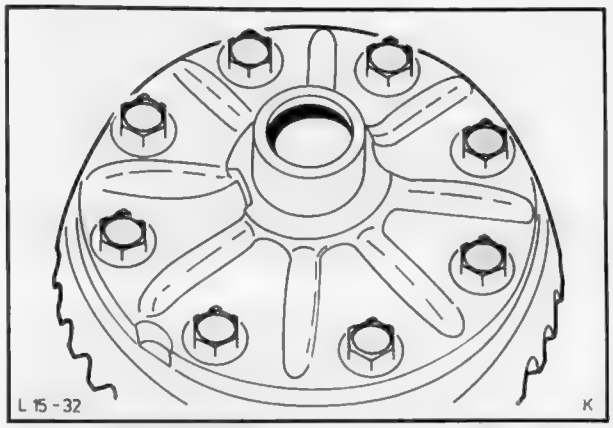


Fig. 66. Secure crown wheel evenly on differential housing

14. Remove and install inner cup of drive pinion taper roller bearing with Special Tool, Fig. 67.

    NOTE: Only replace one bearing cup at a time as one cup always serves to support the installing tool.

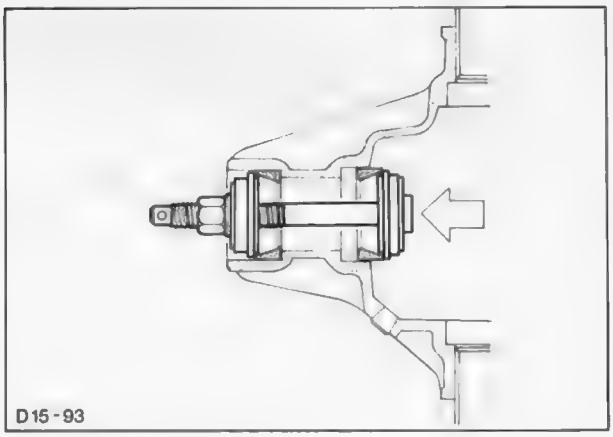


Fig. 67. Install outer bearing cup

Establish Thickness of Drive Pinion Shim

15. Slide removed shim (or a new shim of any thickness) onto the master pinion together with the inner taper roller bearing and secure with the conical nut, Fig. 68.

    NOTE: Moisten taper roller bearing with rear axle oil.

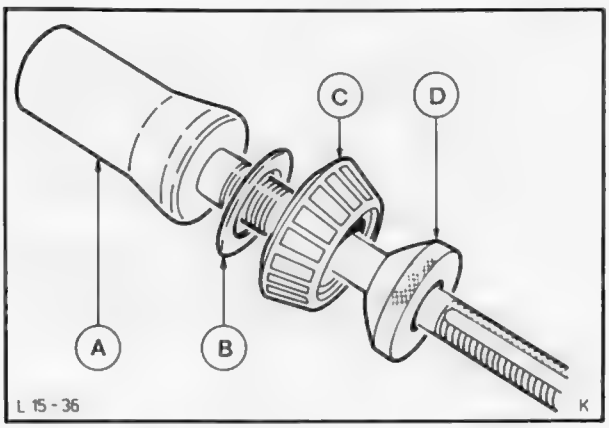


Fig. 68. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

16. Insert master pinion in casing, slide on outer bearing and handle, screw on pre-load sleeve. Hold master pinion handle still and turn hexagon of pre-load sleeve clockwise until, in the case of new bearings, the outer bell of the tool lines up on the C mark (use B mark for used bearings), Fig. 69.

17. With the pre-load gauge, measure and note the torque now needed to turn the master pinion.

    NOTE: This torque reading must be the same when the drive pinion has been installed. If the reading is 2,3 Nm (23 cmkp) for example, this must also be the reading once the drive pinion is fitted (+3 cmkp for the friction of oil seal).

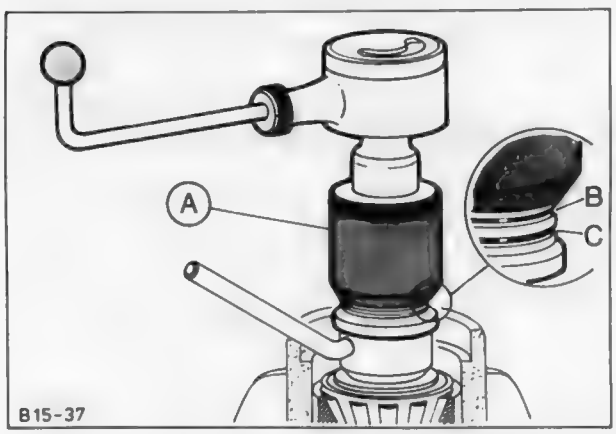


Fig. 69. Pre-load sleeve 15–023
A – Pre-load sleeve
B – Mark for used bearings
C – Mark for new bearings

18. Insert gauge bar with the bearings to be installed in rear axle casing, Fig. 70. Fit the bearing caps (numbers match) and secure to specified torque, slacken again and then do up finger-tight.

    NOTE: Moisten bearings with rear axle oil before fitting.

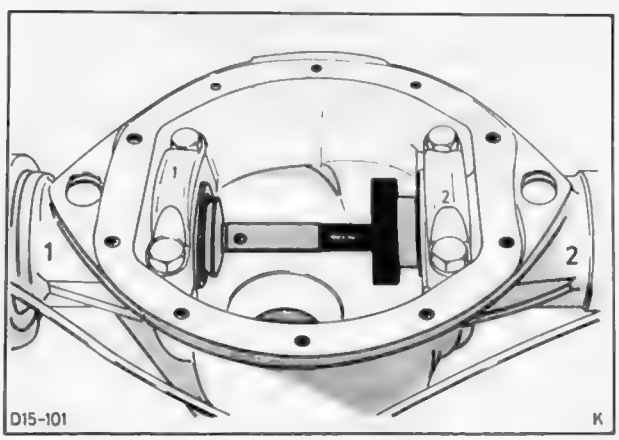


Fig. 70. Gauge bar located in rear axle casing

19. Hold gauge bar still with suitable mandrel, Fig. 71, and turn adjusting nut outwards until gauge bar can just be turned by hand by the adjusting nut (after removing mandrel). Turn gauge bar several times so that bearings seat correctly.

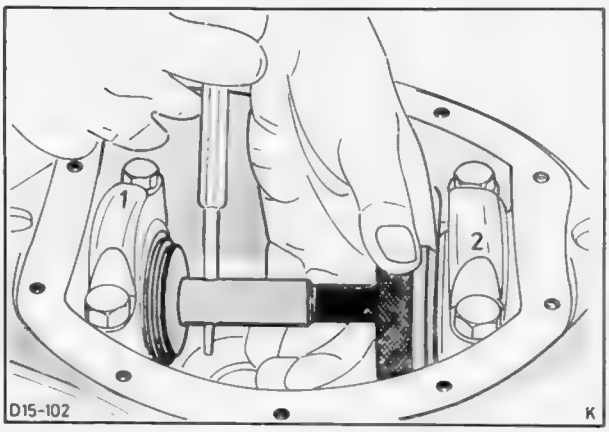


Fig. 71. Set up gauge bar special tool no. 15–019

20. Secure dial indicator 15–046 with holding fixture 15–008–01, to axle casing and position plunger of dial indicator on middle of gauge bar, Fig. 72. Turn bar slowly and observe total deflection of dial pointer. Then turn gauge bar until dial indicator reading is half the measured deflection. After this the gauge bar must not be moved.

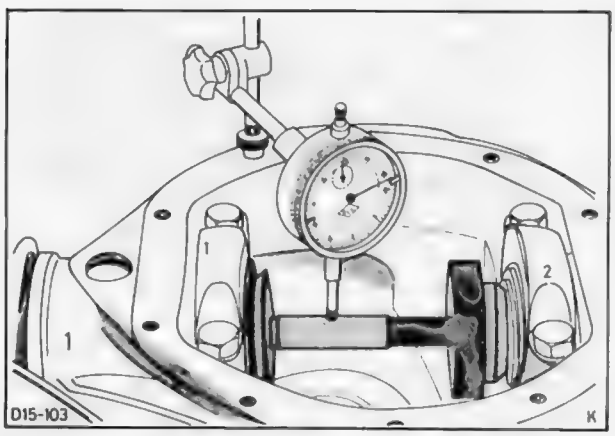


Fig. 72. Adjust gauge bar

21. Set up master pinion. To do this, position dial indicator on outer edge of end of master pinion close to the gauge bar, Fig. 73. Rotate gauge bar another full turn and note total deflection on indicator. Then continue turning master pinion until dial indicator reading is half the total deflection measured. After this, the master pinion must not be moved.

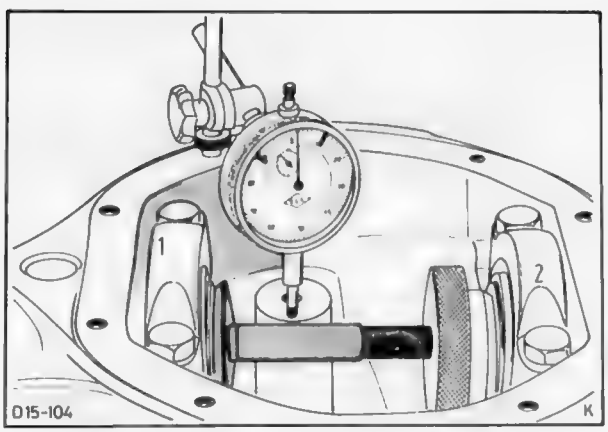


Fig. 73. Adjust master pinion special tool no. 15–020

15 214 8 (cont'd)

'F' AXLE

22. Remove dial indicator from holding fixture and fit in mounting block 15–008. Place mounting block with dial indicator on a ground surface and set to 'O' with the aid of the setting gauge as shown, Fig. 74.

NOTE: The code letters for the rear axles are engraved on the setting gauge under the steps in question, e.g. 'A+E'. Before measuring an 'F' rear axle the dial indicator must be zeroed on step F.

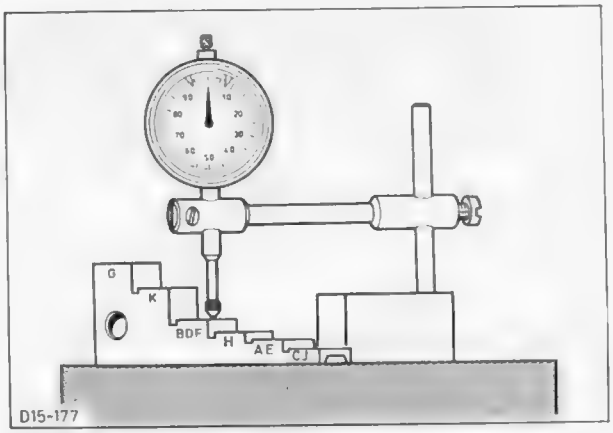


Fig. 74. Zero the dial indicator using setting gauge 15–008–03B

23. Place mounting block with dial indicator on the centre of the end of the master pinion and move the plunger slowly across the gauge bar. Observe dial indicator and stop at the precise point where the pointer changes direction. Repeat this operation several times and ensure maximum precision, Figs. 75/76.

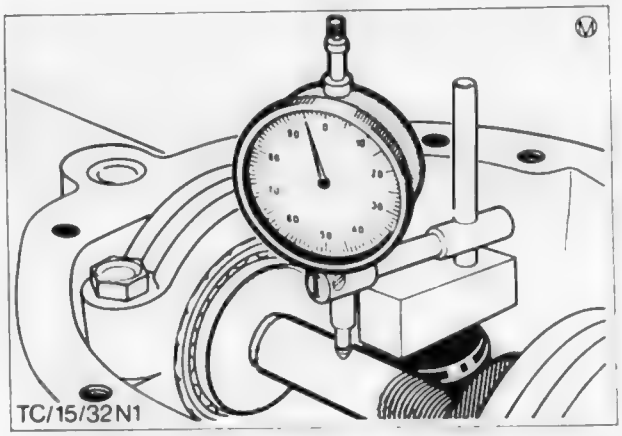


Fig. 75. Dial indicator reading 95 – shim under master pinion too thick

NOTE: If dial indicator pointer now stands at 95 for example, the shim under the master pinion is 0,05 mm too thick. If the pointer changes direction at 4 for example, the shim is 0,04 mm too thin. (This assumes a dial indicator in which pointer moves clockwise when plunger is pressed in).

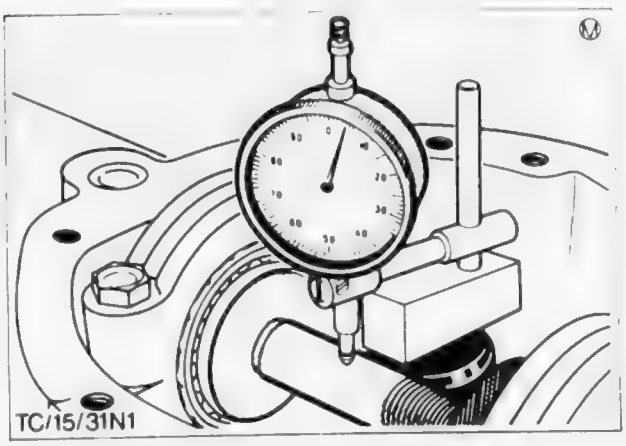


Fig. 76. Dial indicator reading 4 – shim too thin

Example

Thickness of shim under master pinion:	1,25 mm
Dial indicator reading to left of 'O' e.g. 95:	–0,05 mm
	1,20 mm

This value is thickness of shim needed between taper roller bearing and top of drive pinion.

24. Remove master pinion and detach taper roller bearing with shim, Fig. 77. Identify new shim from measurement. With a micrometer check shim corresponding to measured value (see Parts Catalogue for part numbers of shims).

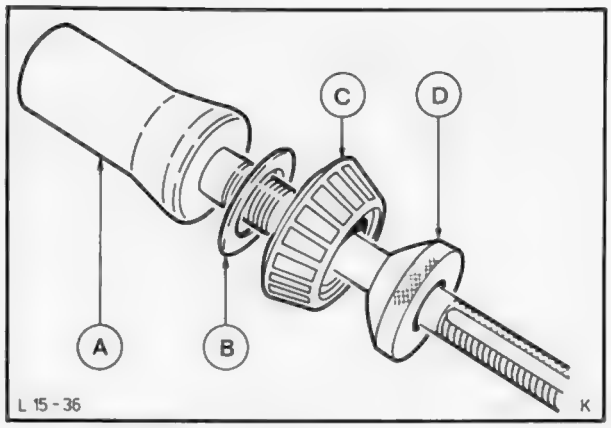


Fig. 77. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

25. Slide chosen shim onto master pinion and screw up conical nut.

26. Fit master pinion as indicated in sub-operation 16.

27. Set up master pinion as indicated in sub-operation 21.

28. Re-check zero setting of dial indicator in dial indicator mounting block using setting gauge and place mounting block on the end of the master pinion. If dial indicator plunger is now moved across gauge bar as before (sub-operation 23), indicator reading must be 'O' if previous measurements were accurate. Discrepancies of up to 0,01 mm from 'O' are permissible, Fig. 78.

But if deviations from 'O' are more, measurement must be repeated as described and a new shim chosen. **Repeat check operation.**

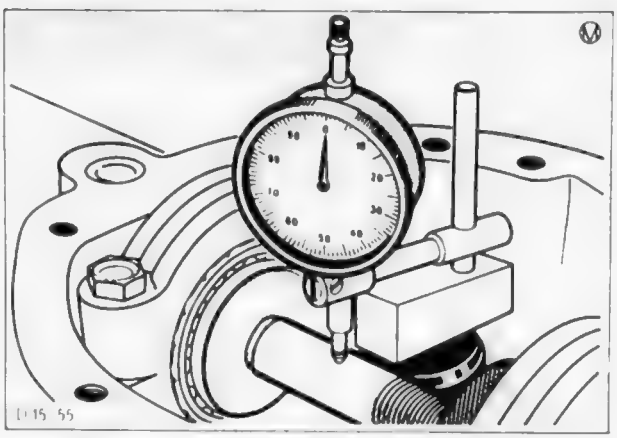


Fig. 78. Dial indicator at 'O' (max. deviation 0,01 mm)

29. Remove master pinion and gauge bar. Detach taper roller bearing and chosen shim from master pinion, Fig. 79.

NOTE: Taper roller bearing and differential bearing cup must not be used for other side after removal.

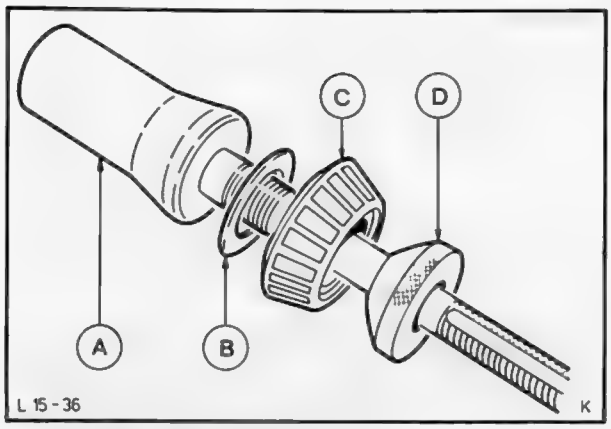


Fig. 79. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

30. Press taper roller bearing and chosen shim onto drive pinion.

31. Press on both differential housing taper roller bearings with Special Tool, No. 15–031 Fig. 80.

NOTE: First fit a taper roller bearing on the crown wheel rear side of the differential housing.

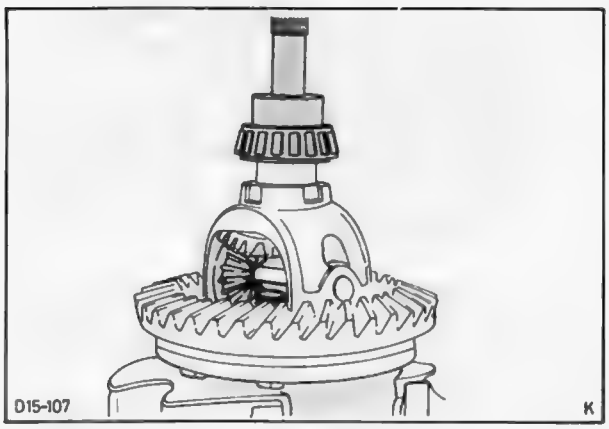


Fig. 80. Fit taper roller bearing with special tool no. 15–031

Establish Thickness (Total Thickness) of Differential Housing Shims

32. Insert thrust buttons in axle tube, Fig. 81, and insert differential assembly with bearing cups. Fit bearing caps (numbers match) and tighten bolts. Turn differential train several times and re-check value at spindle with torque wrench—5 Nm (0,5 mkp). Secure dial indicator to axle casing so that plunger bears on crown wheel boss.

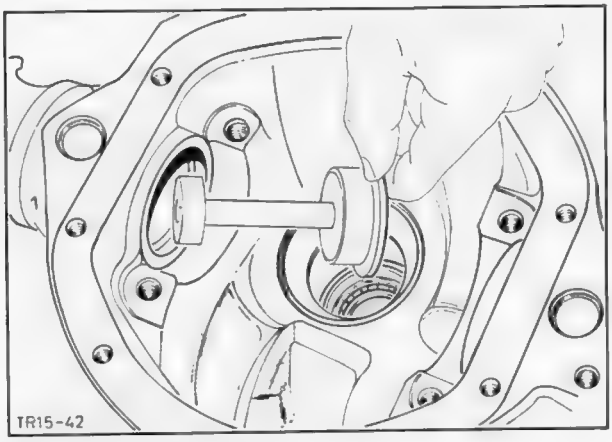


Fig. 81. Insert thrust buttons

33. Then insert spindle in the other axle tube and tighten to a torque of 5 Nm (0,5 mkp) again, Fig. 82.

NOTE: Do not turn differential train any more.

Depending on the side from which pressure is exerted, dial indicator needle will move clockwise or anti-clockwise and must therefore be watched carefully during measuring. Read off value shown by dial indicator and note down as this is total play of differential housing in axle casing (e.g. 1,35 mm), Fig. 83.

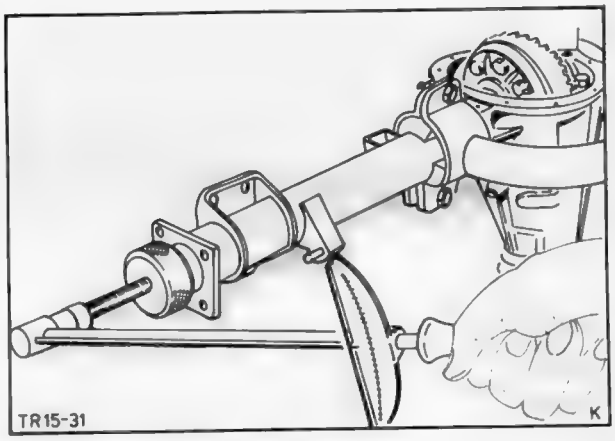


Fig. 82. Insert spindle 15–021 and tighten

34. Release spindle. Swing dial indicator to one side. Remove differential assembly, spindle and thrust buttons.

NOTE: From now on, taper roller bearings and differential bearing cups must not be interchanged.

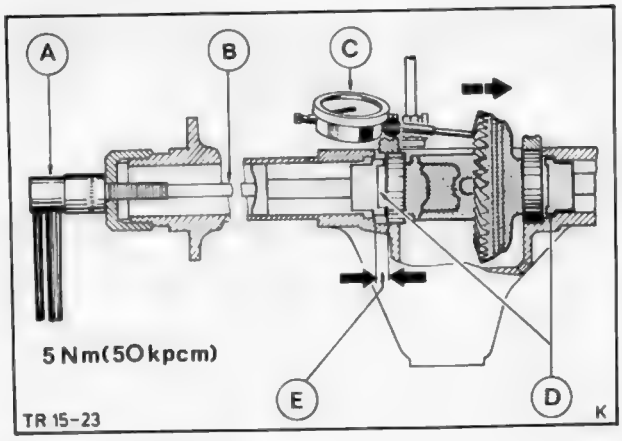


Fig. 83. A – Torque wrench
B – Spindle 15–021
C – Dial indicator
D – Thrust buttons
E – Total play of differential housing

To Install Drive Pinion

35. Insert outside taper roller bearing in axle casing.

36. Fit oil seal with Special Tool. Grease in seal as supplied must not be removed, Fig. 84.

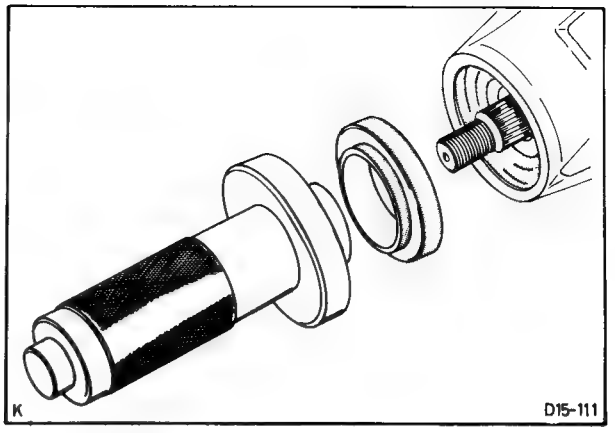


Fig. 84. Fit oil seal with special tool 15–047A

37. Fit drive pinion with new clamping sleeve, fit on drive pinion flange and attach new nut, Fig. 85. Hold flange with Special Tool No. 15–030 and tighten nut, taking repeated torque measurements, until value found previously (+0,3 Nm (3 cmkp) for oil seal friction) is reached. (Measure torque with pre-load gauge 15–041, Fig. 86).

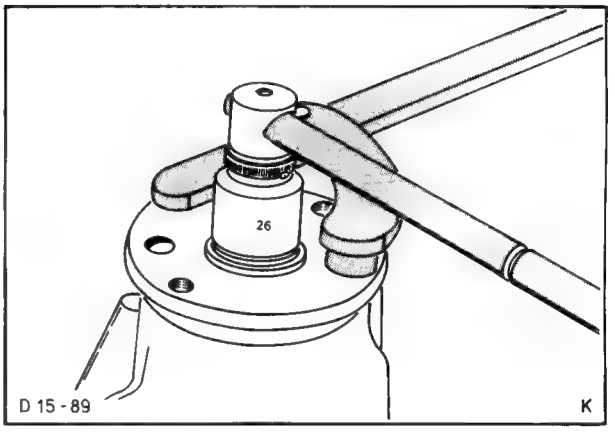


Fig. 85. Hold drive pinion flange and tighten nut slowly

NOTE: If nut of drive pinion is tightened too far and required torque is exceeded, a new clamping sleeve must be fitted.

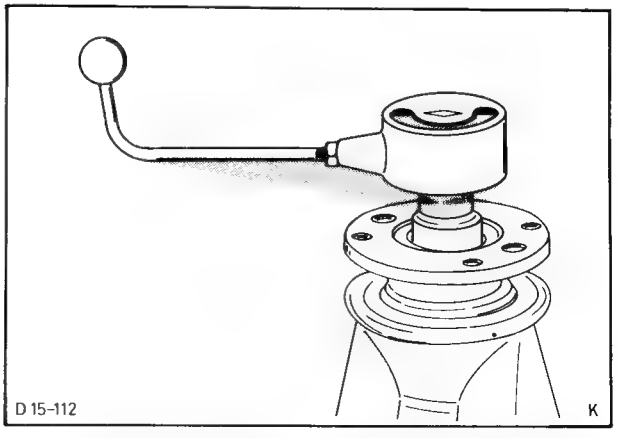


Fig. 86. Check running torque of drive pinion using pre-load gauge 15–041

To Establish Drive Pinion/Crown Wheel Backlash

38. Slip both thrust buttons back into the axle tubes, Fig. 87. Place differential assembly with bearing cups in axle casing. Fit bearing caps. Tighten bolts and slacken them again, do them up very lightly with the wrench.

39. With spindle, press differential housing away from drive pinion as far as stop with torque of 5 Nm (0,5 mkp). Turn drive pinion several times. Check again that torque is 5 Nm (0,5 mkp).

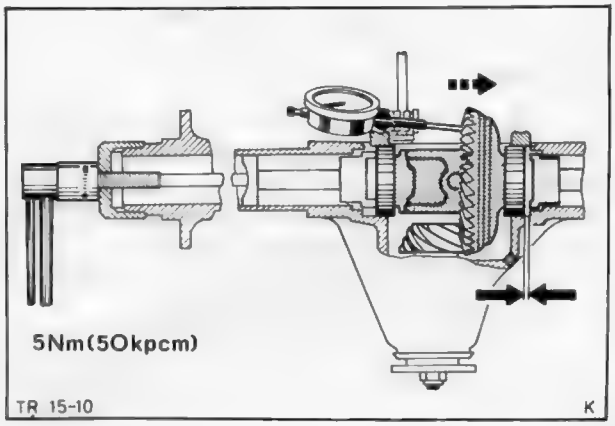


Fig. 87. Press differential housing away from drive pinion with spindle. Read value on dial indicator.

40. Place dial indicator plunger at right angles on one of the crown wheel teeth, Fig. 88. Measure backlash at four points (turning crown wheel on in increments of two bolt-heads). Discrepancies in backlash must not exceed 0,05 mm. Introduce spindle in the other axle tube and screw in slowly until backlash of 0,01 mm is measured.

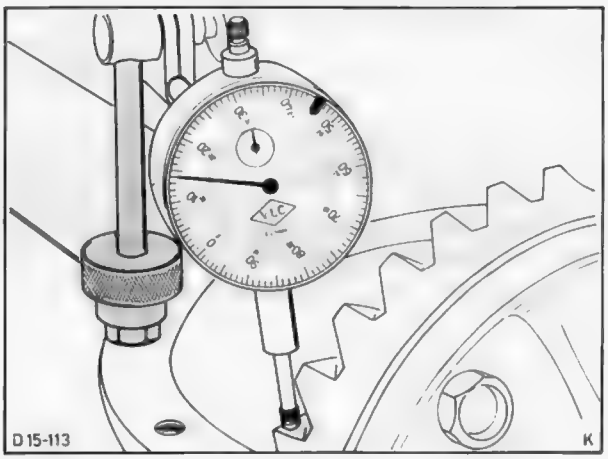


Fig. 88. Place dial indicator plunger at right angles on one of crown wheel teeth

41. Now position dial indicator with plunger inside on crown wheel boss, Fig. 89. Set scale to 'O'. Then fit spindle in the other axle tube and screw in with tightening torque of 5 Nm (0,5 mkp). Read off and note value shown on dial indicator (e.g. 0,64 mm).

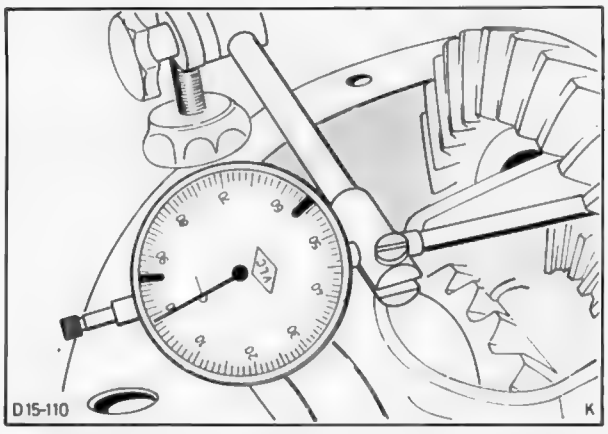


Fig. 89. Place dial indicator plunger on inner crown wheel boss

Remove spindle, differential and thrust buttons from the axle casing.

Example

Total play measured:	1,35 mm
Mean pre-load (always in addition):	+0,05 mm
	1,40 mm
Measured thickness of shim on crown wheel rear side:	0,64 mm
Deduct value for backlash (this value is constant and has been confirmed by tests):	–0,12 mm
	0,52 mm
Shim thickness on crown wheel side Rest of shims are located on this side of the differential.	
Total play:	1,40 mm
Deduct shim thickness on crown wheel rear side:	–0,52 mm
	0,88 mm

42. Remove differential housing taper roller bearing, Fig. 90. Place removal tool on one of differential housing bearings and clamp in vice by one leg. Remove both bearings in this way, one after the other.

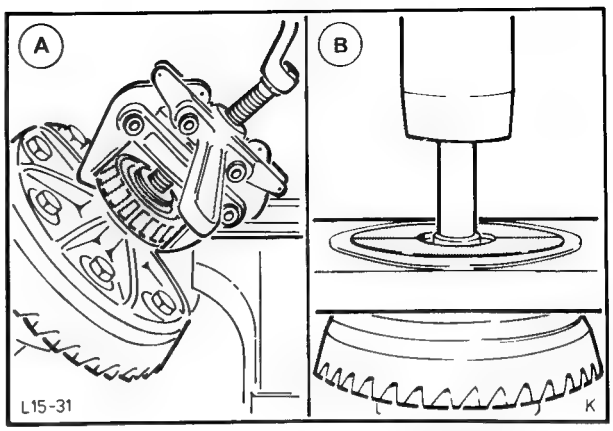


Fig. 90. Remove differential housing taper roller bearing using special tool 15–026A
A – Special Tool 15–026A
B – Alternative method using press

43. Refit taper roller bearings to differential housing with chosen shims, Fig. 91, as described in sub-operation 31.

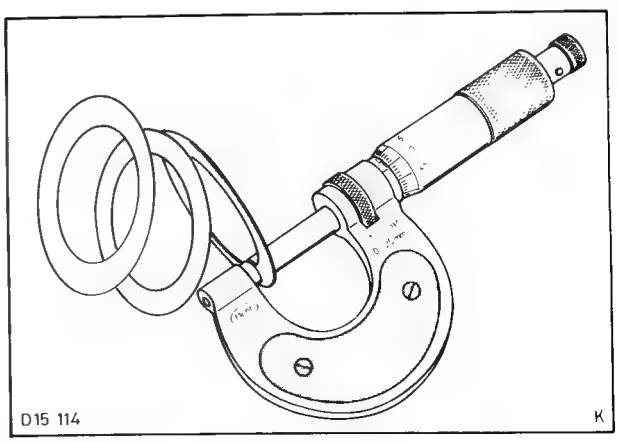


Fig. 91. Choose correct shims

To Install Differential Assembly

44. Press differential assembly into rear axle. Fit bearing caps (numbers match), Fig. 92. Coat bolts with sealing compound when inserting.

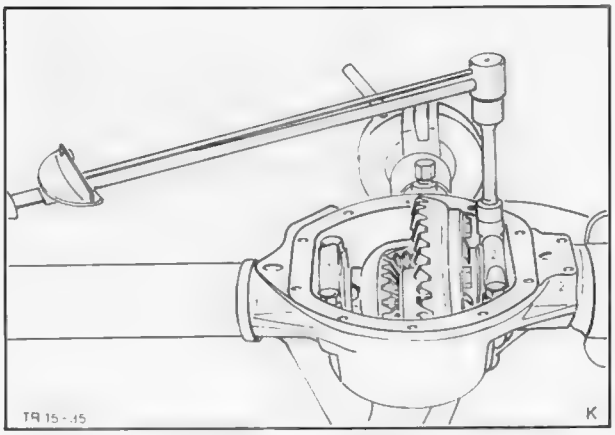


Fig. 92. Fit bearing caps (numbered) and torque bolts as specified

45. Measure backlash. If backlash is not between 0,1 and 0,2 mm, differential assembly must be removed again, Fig. 93.

NOTE: 0,12 mm to 0,22 mm for 'F' axle.

If backlash is too much, shims must be removed on crown wheel side (long side) and placed under the other taper roller bearing. Proceed other way round if backlash is too small. Do not take away or add any shims in the process. Only interchange from one side to the other.

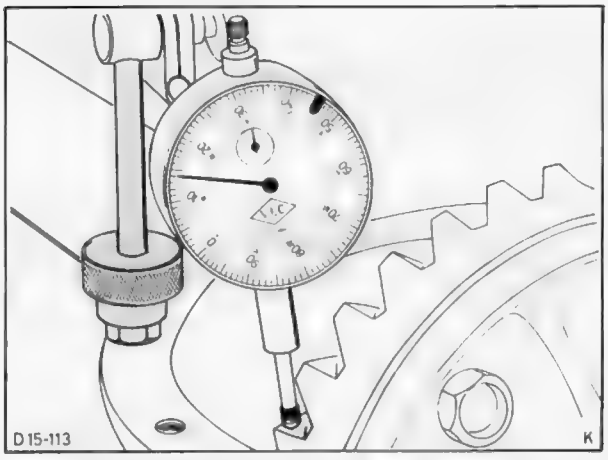


Fig. 93. Position dial indicator plunger at right angles on one of crown wheel teeth

46. Check tooth pattern: New crown wheels will still show optimum tooth pattern markings produced by testing in the factory.

Coat crown wheel teeth with marker. Fit wrench on drive pinion nut and turn until all crown wheel teeth have been in mesh, braking crown wheel with wooden wedge, Fig. 94.

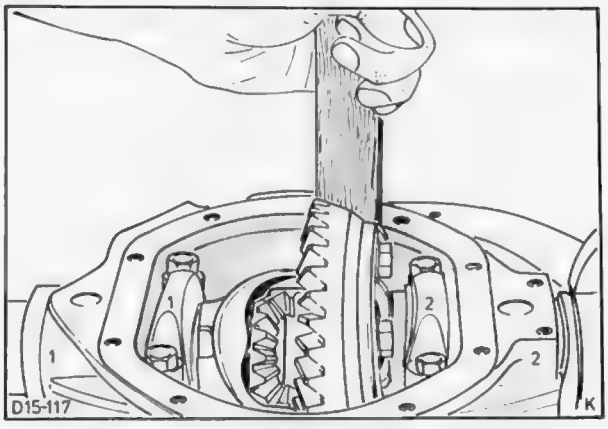


Fig. 94. Brake crown wheel with hard wooden wedge

15 214 8 (cont'd) 'F' AXLE

Backlash has great effect on tooth pattern, Fig. 95. If tooth pattern is unsatisfactory, rectification can only be made by increasing or reducing backlash within tolerances. In the process do not take away or add any shims, but interchange them from one or other side of differential. 0,01 mm shim thickness is equivalent to 0,01 mm of backlash.

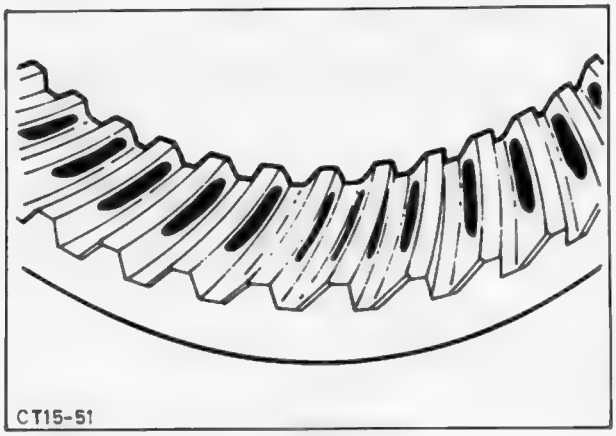


Fig. 95. Optimum tooth pattern

47. Attach cover to rear axle casing. Coat bolts with sealing compound on insertion.
48. Detach rear axle from stand.

15 254 DIFFERENTIAL ASSEMBLY – REMOVE AND INSTALL 'H' AXLE

Special Service Tools Required: None

To Remove

1. Slacken wheel nuts and jack up vehicle. Fit stands.
2. Remove rear wheels.
3. Disconnect driveshaft from rear axle flange (4 bolts).
4. Detach brake drums.
5. Remove axle half-shafts (5 bolts on each side).
6. Remove differential assembly from rear axle (8 bolts), Fig. 96.

   NOTE: Catch oil spills.

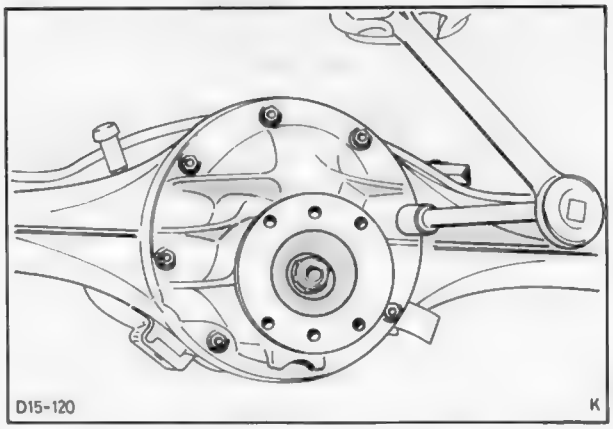


Fig. 96. Attachment of differential and axle casing

15 254 (cont'd)

To Install

7. Fit differential assembly in rear axle, Fig. 97.
8. Insert half-shafts and secure.
9. Attach brake drums.
10. Connect driveshaft to rear axle flange.
11. Refit wheels and lower vehicle to ground.
12. Tighten wheel nuts.
13. Fill rear axle with oil.

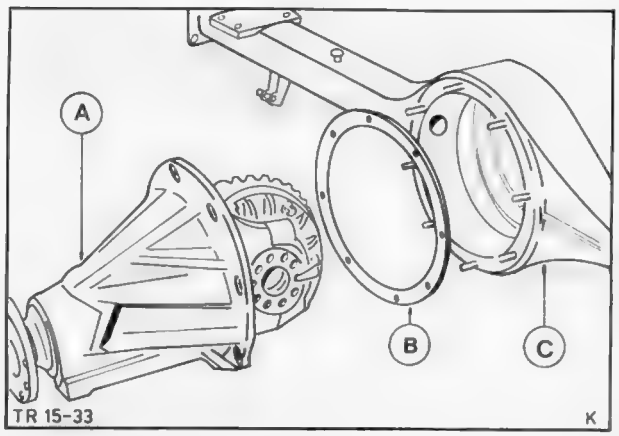


Fig. 97. A – Differential assembly
B – Gasket
C – Axle casing

15 254 8 DIFFERENTIAL ASSEMBLY – OVERHAUL ('H' Axle)

Special Service Tools Required:

Dial indicator mounting block	15–008
Setting gauge	15–008–03B
Gauge bar	15–019
Master pinion	15–020
Dial indicator holding fixture	15–022A
Pre-load sleeve	15–023
Differential bearing remover	15–026A
Universal flange holding wrench	15–030
Pinion bearing cup installer	15–033
Pre-load gauge	15–041
Drive pinion bearing installer	15–042
Dial indicator	15–046
Drive pinion oil seal installer	15–047B
Drive pinion bearing remover	15–054
Rear axle mounting bracket	16–009

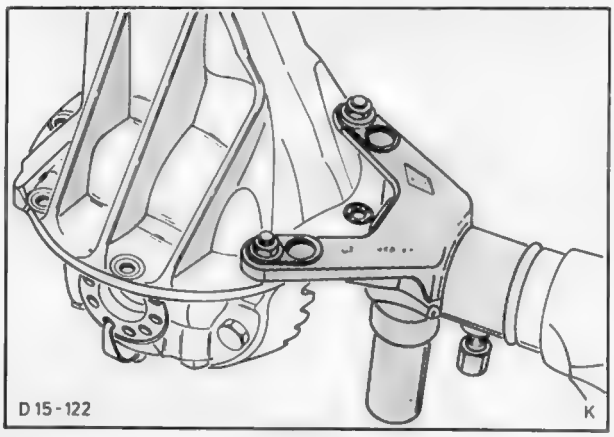


Fig. 98. Differential assembly in mounting bracket 16–009 on stand

To Remove Drive Pinion and Differential Train

1. Mount differential assembly on stand, Fig. 98.
2. Detach locking elements from ring nuts (2 bolts).
3. Remove differential gear train. To do this, detach differential bearing caps (4 bolts) and take gear train and adjusting nuts out of the housing.

   NOTE: Mark right and left sides of bearing caps and differential housing, Fig. 99.

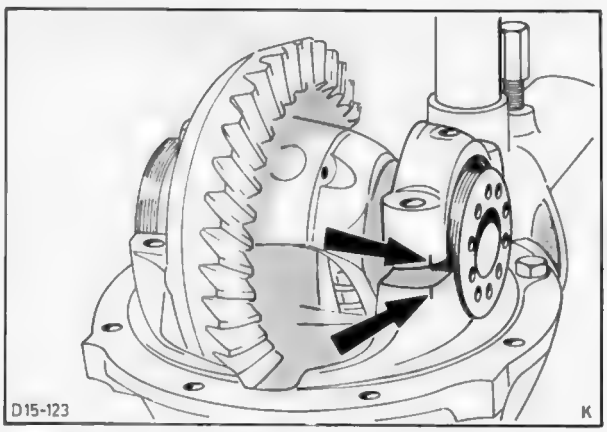


Fig. 99. Mark bearing caps and unbolt

4. Remove drive pinion (1 nut). Hold flange with Special Tool No. 15–030, Fig. 100, unscrew nut and tap out drive pinion downwards with a soft faced hammer. Detach flange, Fig. 101.

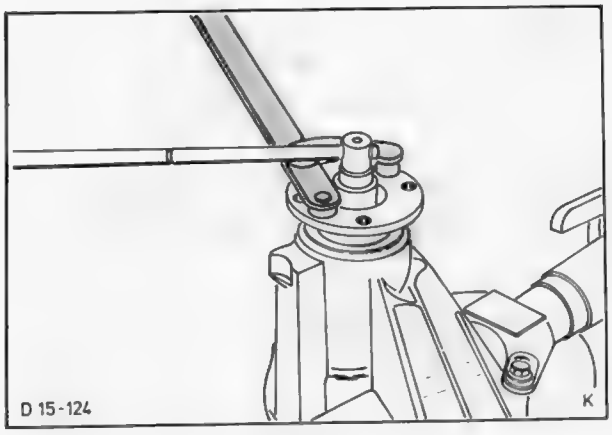


Fig. 100. Hold drive pinion flange and unscrew nut

5. Press oil seal and outer taper roller bearing out of housing simultaneously using Special Tool 15–042.

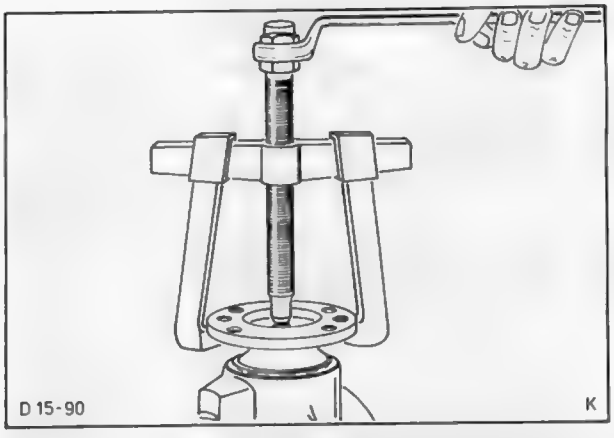


Fig. 101. Remove drive pinion flange with standard remover

6. Detach inner taper roller bearing from drive pinion with Special Tool, Fig. 102.

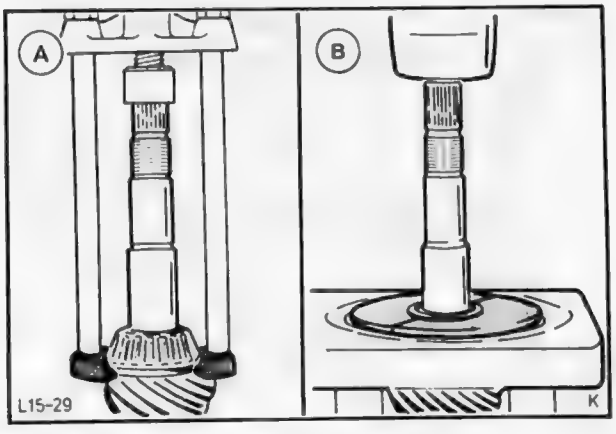


Fig. 102. Remove large taper roller bearing
A – Tool 15–054
B – Base plate 15–059 with adaptor 15–059–01

To Dismantle Differential Gear Train

7. Detach differential taper roller bearing from differential housing (both sides). Clamp Special Tool in a vice by one leg and pull off bearing, Fig. 103.

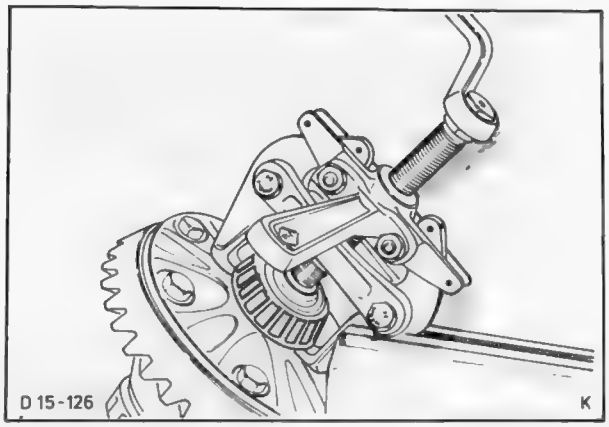


Fig. 103. Detach taper roller bearing from differential housing

8. Detach crown wheel from differential housing (8 bolts), Fig. 104, by slackening 3 bolts spaced out on the periphery (remove rest completely) so that crown wheel can be removed by tapping the bolt heads.

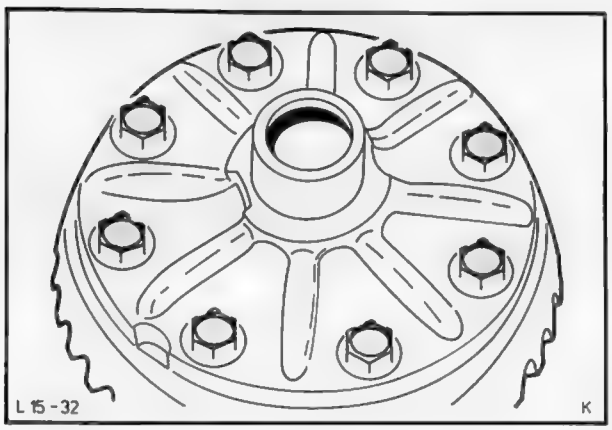


Fig. 104. Detach crown wheel from differential housing

9. Remove differential gears and side gears from differential housing, Fig. 105. Separate halves of housing with a copper mandrel, lift out the differential gears with differential cross or shaft and side gears. Remove shims.

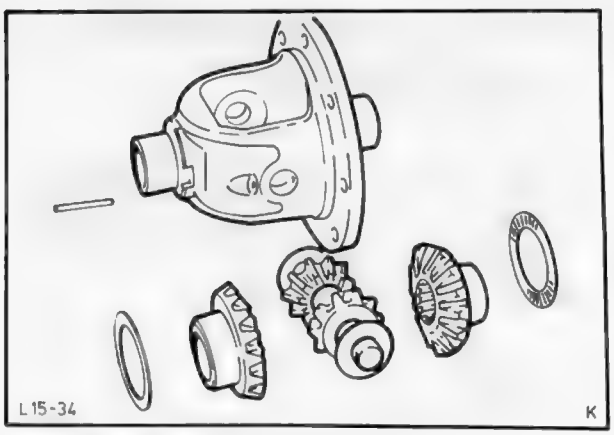


Fig. 105. Differential gear train exploded

To Reassemble Differential

10. Install differential gears and side gears in the differential housing. Fit side gears with shims and differential gears with thrust washers and differential cross or shaft in housing halves in the reverse order. Bring differential housing halves together, Fig. 106.

    NOTE: Use new bolts. Heat crown wheel before fitting it.

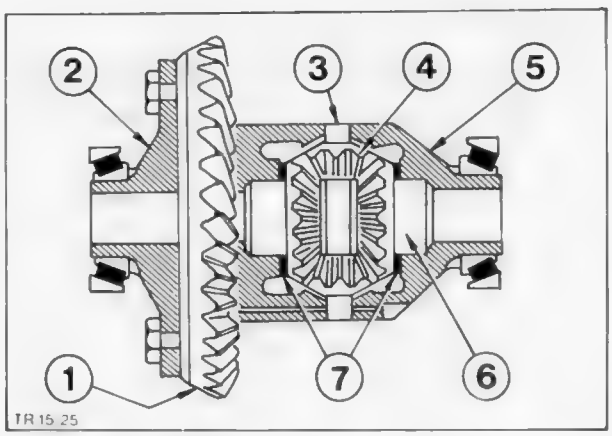


Fig. 106. Differential gear train
1 – Crown wheel
2 – Housing half
3 – Differential shaft
4 – Differential gear
5 – Housing half
6 – Side gear
7 – Shims

11. Fit crown wheel (8 bolts), securing crown wheel evenly on differential housing.

To Replace Drive Pinion Bearing Cups

12. Remove and install outer bearing cup of drive pinion taper roller bearing using Special Tool, Fig. 107.

13. Remove and install inner bearing cup of drive pinion taper roller bearing using Special Tool.

    NOTE: Only change one bearing cup at a time because one bearing cup always serves as support for the installing tool.

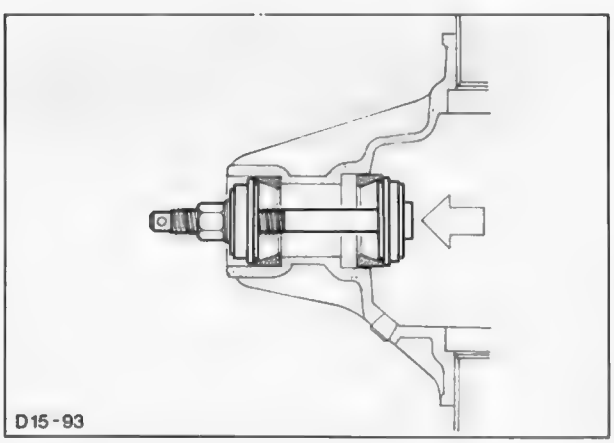


Fig. 107. Install outer bearing cup

To Establish Thickness of Shim for Drive Pinion

14. Slide shim that has been removed or a new shim of any thickness together with the inner taper roller bearing onto the master pinion, Fig. 108.

    NOTE: Moisten taper roller bearing with rear axle oil and secure with conical nut.

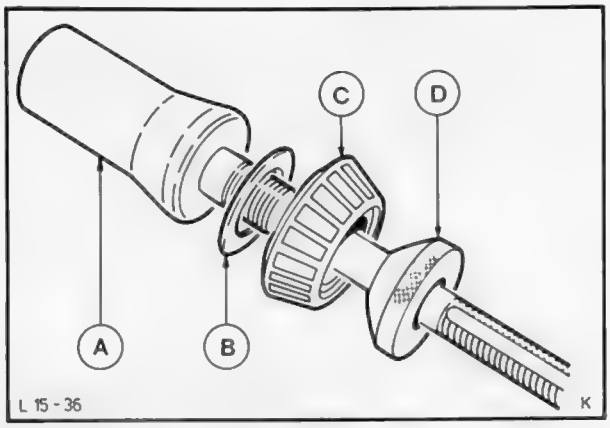


Fig. 108. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

15. Insert master pinion in axle casing, slide on outer bearing and handlè, screw on pre-load sleeve. Hold handle of master pinion still and turn hexagon of pre-load sleeve clockwise until, with new bearings, the outer bell of the tool lines up on the 'C' mark (use 'B' mark for used bearings).

    Turn master pinion several times so that the bearings settle.

16. Measure torque now needed for rotation with pre-load gauge and note value, Fig. 109.

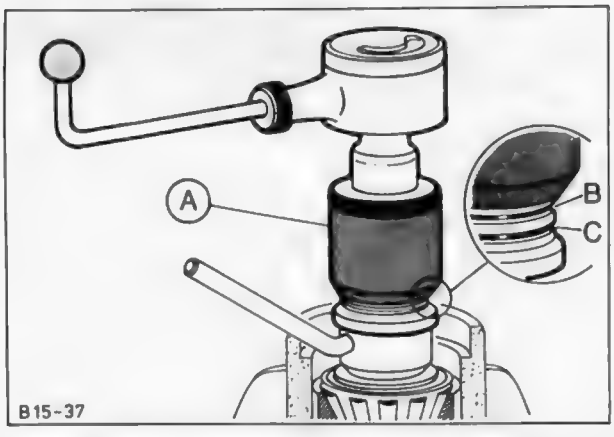


Fig. 109. Pre-load sleeve 15–023 and pre-load gauge 15–041
A – Pre-load sleeve
B – Mark for used bearings
C – Mark for new bearings

15 254 8 (cont'd) **'H' AXLE**

NOTE: This torque reading must be the same when the drive pinion is installed. If for instance reading is 2,3 Nm (23 cmkp), this value must also be repeated (+0,3 Nm (3 cmkp) for oil seal friction) when drive pinion has been fitted.

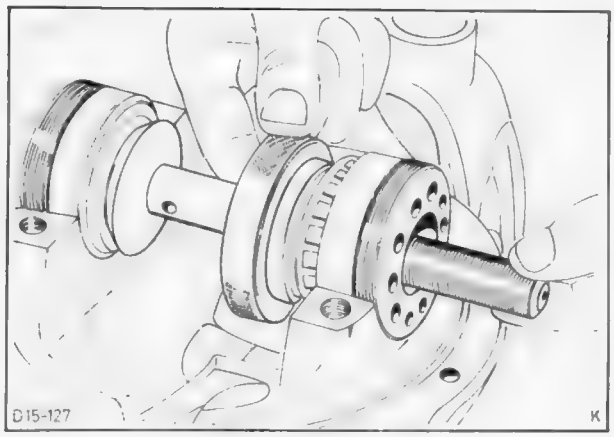


Fig. 110. Insert gauge bar

17. Insert gauge bar in casing with bearings to be installed and ring nuts, Fig. 110. Fit bearing caps ('R'/'L') and secure bolts with prescribed torque, slacken again and then do up finger-tight.

NOTE: Do up adjusting nuts until they just touch the bearing cups. Oil bearings before insertion, Fig. 111.

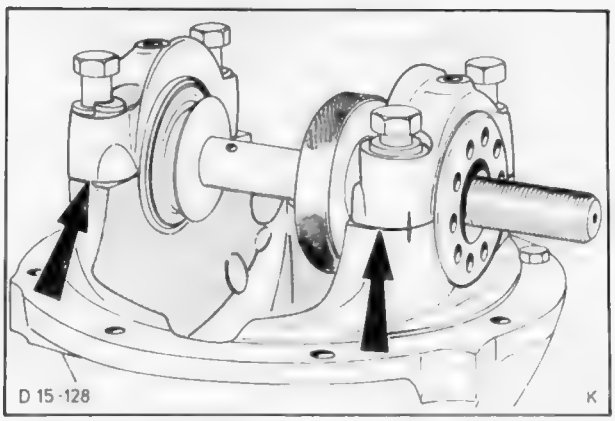


Fig. 111. Fit bearing caps ensuring correct location (arrow)

18. Hold gauge bar with a suitable mandrel and turn adjusting nut outwards until gauge bar can just be turned by hand at adjusting nut (after removing mandrel). Turn gauge bar several times so that bearings settle.

19. Adjust gauge bar. To do this, secure dial indicator with holding fixture on rear axle casing and position plunger on centre of bar, Fig. 112.

    Turn bar slowly and observe total deflection of dial indicator pointer. Then rotate gauge bar until dial indicator reading is half the deflection measured. Thereafter the gauge bar must not be turned any more.

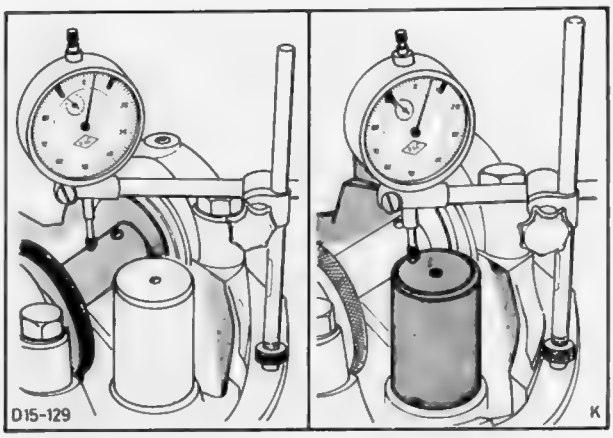


Fig. 112. Adjust gauge bar and master pinion

20. Adjust master pinion. To do this, set up dial indicator on outer edge of end of master pinion close to the gauge bar, Fig. 112. Rotate master pinion another complete turn and observe total deflection of dial indicator needle. Then continue turning master pinion until dial indicator reading is half the total deflection measured.

    After this operation the master pinion must not be turned any more.

21. Remove dial indicator from holding fixture and secure in mounting block. Place mounting block with dial indicator on a ground surface and set to 'O' with the aid of the setting gauge as illustrated, Fig. 113.

    NOTE: The code letters of the rear axles are engraved on the setting gauge under the individual steps, e.g. 'A+E'. Before measuring an 'H' axle, dial indicator must be zeroed on this step.

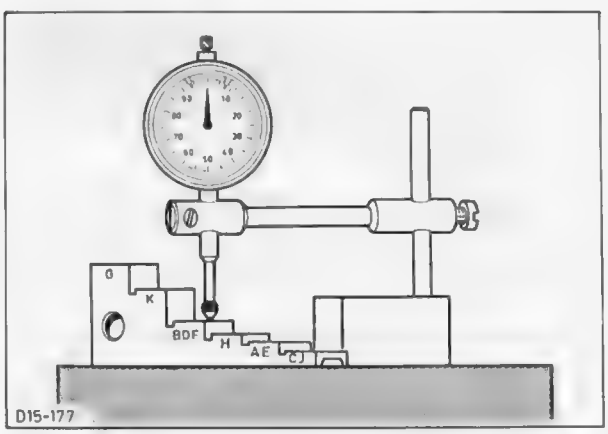


Fig. 113. Zero dial indicator using setting gauge

22. Place mounting block with dial indicator on end of master pinion in the centre and move plunger of dial indicator slowly across gauge bar. Observe dial indicator and stop at the precise point where the pointer changes direction. Repeat this measuring operation several times and ensure great precision, Fig. 114.

    NOTE: If dial indicator pointer now stands at 95 for example, the shim under the master pinion is 0,05 mm too thick. If the pointer changes direction at 4 for example, the shim is 0,04 mm too thin. (This assumes a dial indicator where pointer moves clockwise when plunger is pressed in), Figs. 114/115.

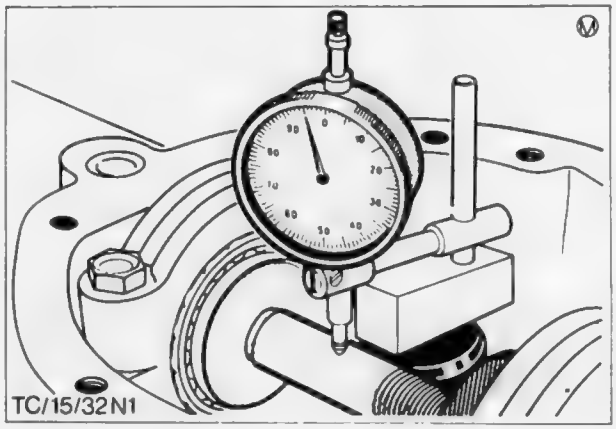


Fig. 114. Dial indicator reading 95 – shim under master pinion too thick

Example

Thickness of shim under master pinion:	3,85 mm
Dial indicator reading left of 'O', e.g. 95:	–0,05 mm
	3,80 mm

This value is the thickness of shims needed between taper roller bearing and top of drive pinion.

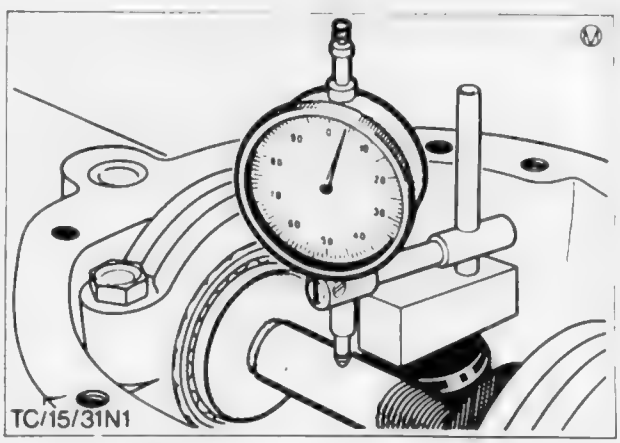


Fig. 115. Dial indicator reading 4 – shim under master pinion too thin

23. Remove master pinion and detach taper roller bearing with shim, Fig. 116. Select new shim according to measurement. With a micrometer measure up shim corresponding to value found, (see Parts Catalogue for shim part numbers).
24. Slide chosen shim onto master pinion and screw up conical nut.
25. Install master pinion as indicated in sub-operation 15.
26. Adjust master pinion as indicated in sub-operation 20.

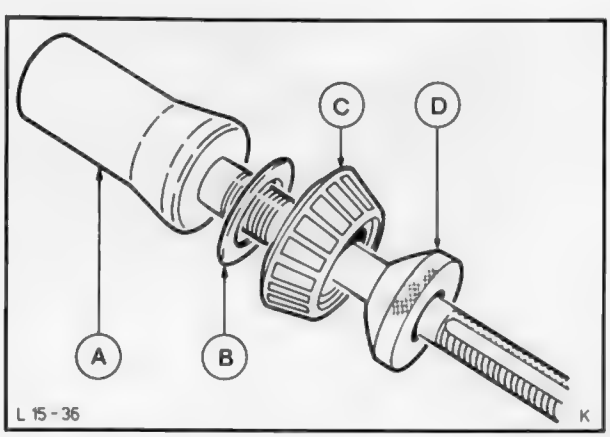


Fig. 116. Master pinion 15–020
A – Master pinion
B – Shim
C – Taper roller bearing
D – Conical nut

27. Re-check zero setting of dial indicator in mounting block with setting gauge and place mounting block on end of master pinion. If dial indicator plunger is now moved across the gauge bar as before (sub-operation 22), dial indicator must read '0' if preceding measurements were accurate. Discrepancies from '0' of up to 0,01 mm are permissible, Fig. 117.

    If larger deviations from '0' are found, the measuring operation must be repeated as described and a new shim found.

    Repeat checking operation.

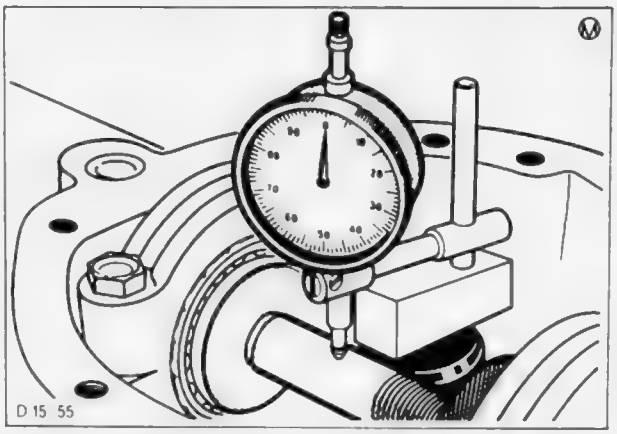


Fig. 117. Dial indicator zeroed (max. discrepancy 0,01 mm)

28. Remove master pinion and gauge bar, Fig. 118. Detach taper roller bearing with chosen shim from master pinion.

    NOTE: After removal, taper roller bearing and differential bearing cup must not be used on the wrong side.

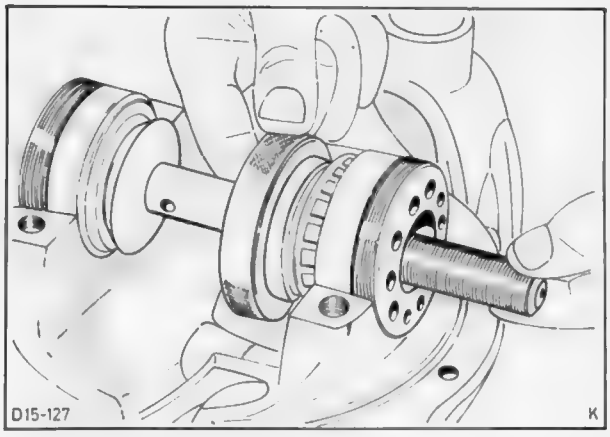


Fig. 118. Remove gauge bar

29. Fit taper roller bearing with chosen shim on drive pinion, Fig. 119.

30. Press on both differential housing taper roller bearings with Special Tool.

    NOTE: First fit a taper roller bearing on the crown wheel rear side of the differential housing.

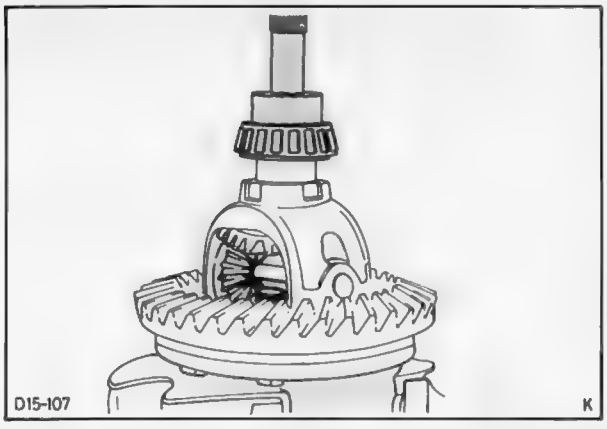


Fig. 119. Fit taper roller bearing with special tool no. 15–025A

To Install Drive Pinion and Differential Gear Train in Housing

31. Insert external drive pinion taper roller bearing in housing.

32. Fit oil seal with Special Tool. Grease on seal when supplied must not be removed, Fig. 120.

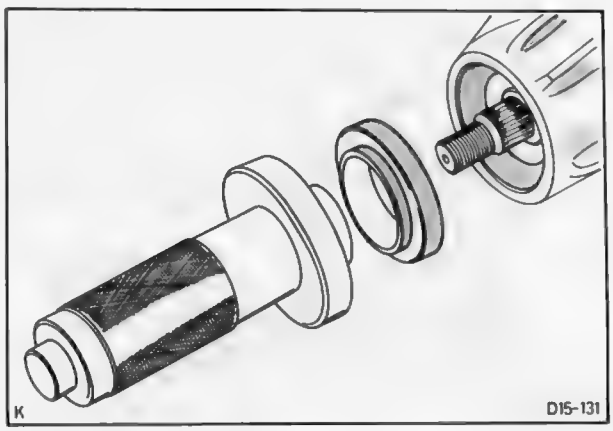


Fig. 120. Install oil seal with special tool no. 15–047B

33. Insert drive pinion with new clamping sleeve in housing. Hold flange with Special Tool No. 15–030 and tighten nut, taking repeated torque readings, until value found previously (+0,3 Nm (3 cmkp) for friction of new oil seal) is attained. Use pre-load gauge, Fig. 121.

NOTE: If permissible torque is exceeded while tightening the drive pinion nut, a new clamping sleeve must be fitted.

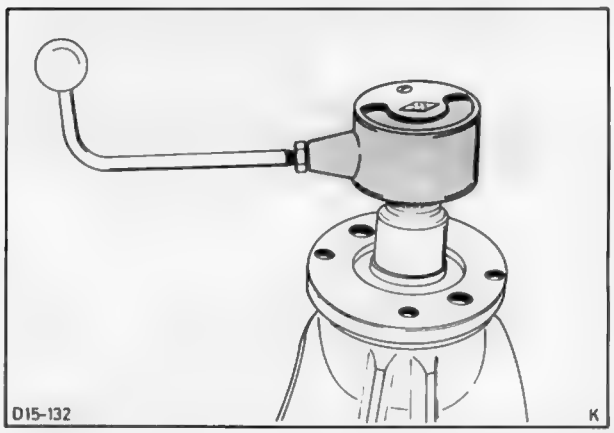


Fig. 121. Check running torque of drive pinion with pre-load gauge 15–041

34. Insert differential assembly with both adjusting nuts in housing, Fig. 122. Fit bearing caps, tighten bolts, slacken and then do up again finger-tight. Adjusting nuts must bear on the bearing cups.

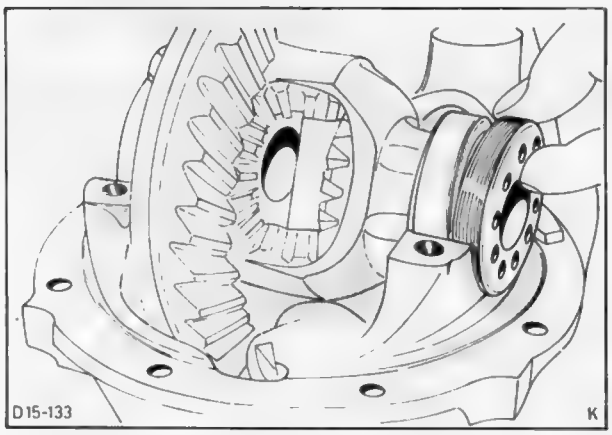


Fig. 122. Insert differential with ring nuts in housing

35. Set backlash. To do this, position plunger of dial indicator at right angles on one of crown wheel teeth, Fig. 123. Tighten adjusting nuts on crown wheel side, slackening nut on differential housing side, so as to produce a backlash of 0,01 mm. Tighten adjusting nut on differential housing side until prescribed backlash of 0,12 to 0,22 mm is attained. Turn drive pinion several times and measure backlash at three points again to check, Fig. 124.

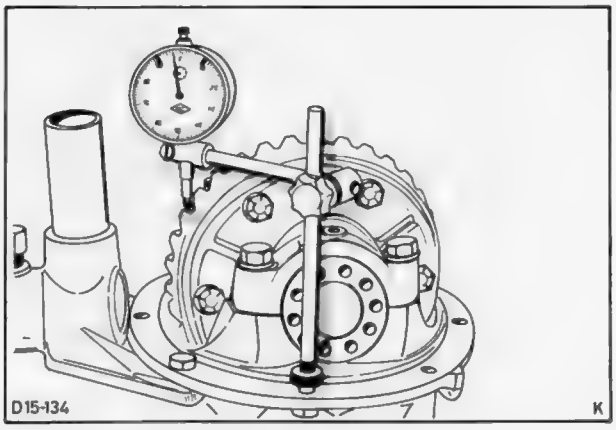


Fig. 123. Position dial indicator plunger at right angles on one of crown wheel teeth

Tighten bearing cap bolts.

Discrepancies in backlash must not exceed 0,01 mm.

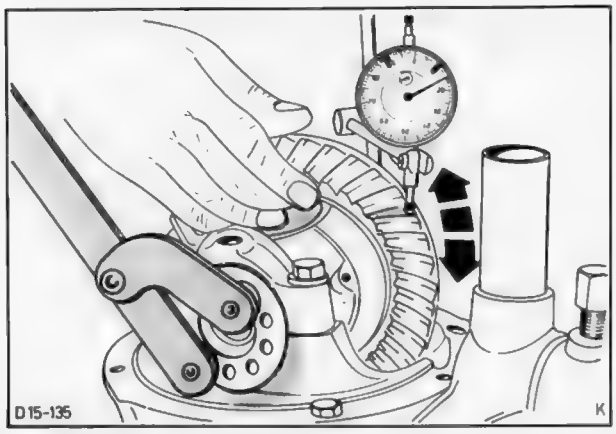


Fig. 124. Set backlash, turning crown wheel to and fro by hand

If backlash has to be rectified, the adjusting nuts can only be turned evenly by the same amounts so as to maintain bearing pre-load, Fig. 125.

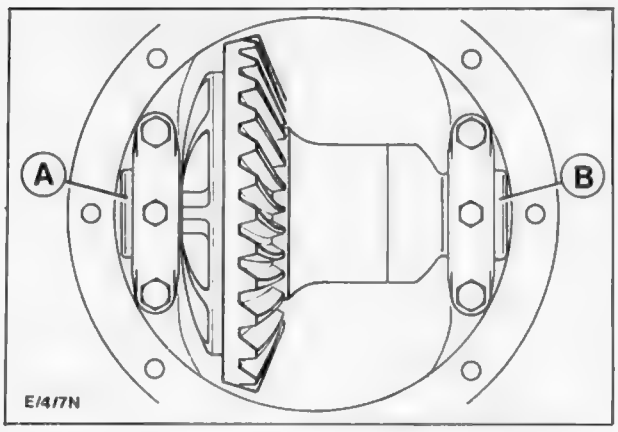


Fig. 125. A – Adjusting nut – crown wheel rear side
B – Adjusting nut – crown wheel front side

36. Check tooth pattern: New crown wheels will still show marks of optimum tooth pattern left during testing at the factory, Fig. 126.

Coat crown wheel teeth with marker. Place wrench on nut of drive pinion flange and turn drive pinion until all teeth have been in mesh, braking the crown wheel by means of a hardwood wedge on the outer periphery, Fig. 127.

As the backlash has a great influence on tooth pattern, an unsatisfactory tooth pattern can only be rectified by increasing or reducing the backlash within the tolerances.

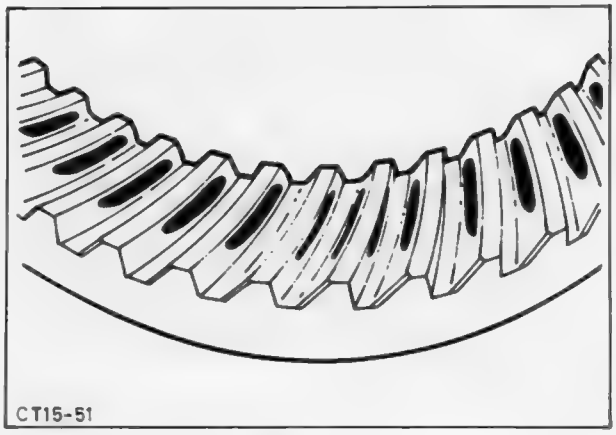


Fig. 126. Optimum tooth pattern

37. Attach locking elements (2) to ring nuts, Fig. 128.

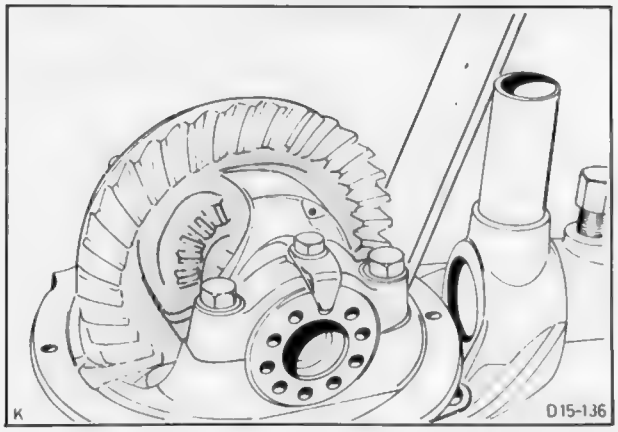


Fig. 127. Brake crown wheel with hardwood wedge

38. Detach differential assembly from stand.

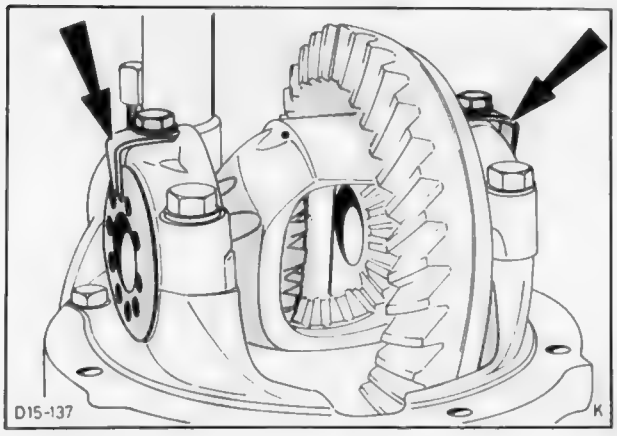


Fig. 128. Lock ring nuts

15 302 SEAL – DRIVE PINION – REPLACE

Special Service Tools Required:

Universal flange holding wrench	15–030
Pre-load gauge	15–041
Drive pinion oil seal installer	15–047B
Drive pinion oil seal remover	15–048

To Remove

1. Slacken wheel nuts. Jack-up vehicle fit stands and remove rear wheels.
2. Disconnect driveshaft from rear axle flange (4 bolts), Fig. 129.

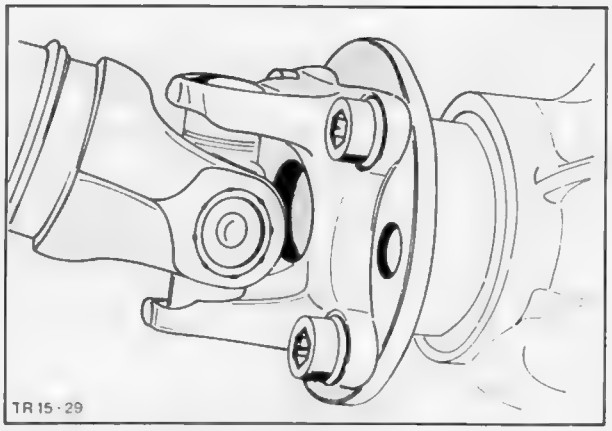


Fig. 129. Detach driveshaft from rear axle flange

3. Measure drive pinion running torque with pre-load gauge, Fig. 130. Turn drive pinion smoothly and read off value and note it down, e.g. 0,8 Nm (8 cmkp).

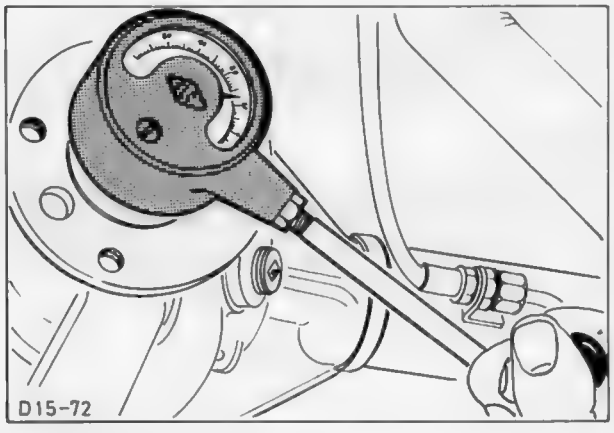


Fig. 130. Check running torque of axle at drive pinion with special tool no. 15–041

4. Hold flange with Special Tool No. 15–030 and unscrew nut.
5. Pull off flange with Conventional Tool.
6. Remove oil seal using Special Tool, Fig. 131.

   NOTE: Position drain can to catch oil spillage.

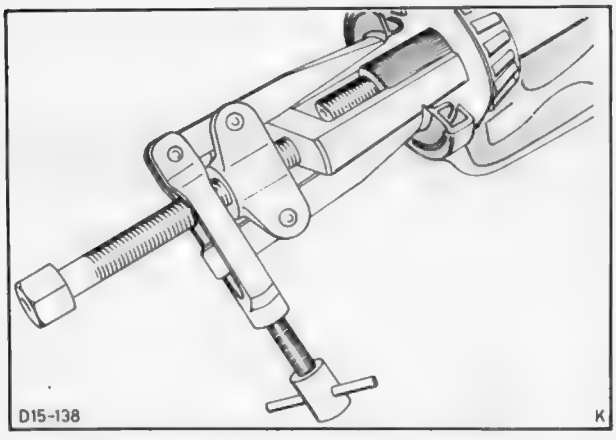


Fig. 131. Remove seal with special tool no. 15–048

To Install

7. Install new oil seal with Special Tool and lightly grease sealing lips, Fig. 132.

   NOTE: Grease on seal when supplied must not be removed.

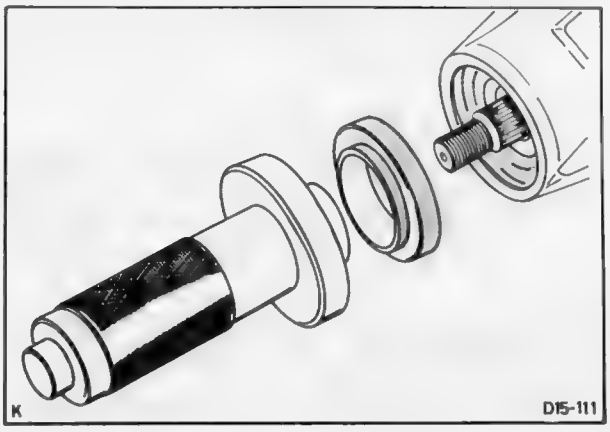


Fig. 132. Fit oil seal with special tool no. 15–047B

8. Slide on flange, screw on new nut and tighten (holding flange with Special Tool), Fig. 133, until repeated checks show that value measured previously has been reached.

Example

Value measured previously	0,8 Nm (8 cmkp)
Constant value	0,4 Nm (4 cmkp)
Torque required	1,2 Nm (12 cmkp)

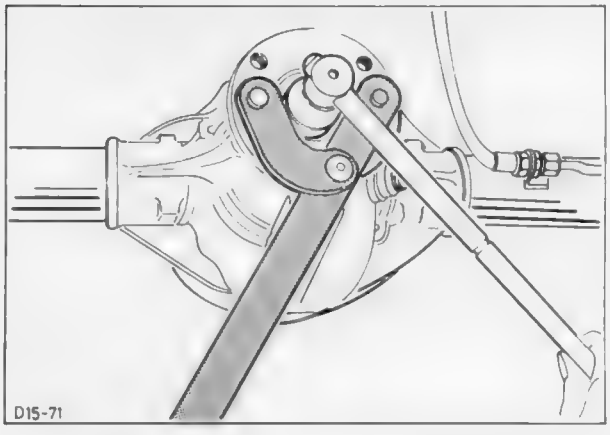


Fig. 133. Hold drive pinion flange and tighten nut slowly

9. Attach driveshaft to rear axle flange, Fig. 134.

10. Attach wheels, top up rear axle oil and lower vehicle to the ground. Fully tighten wheel nuts.

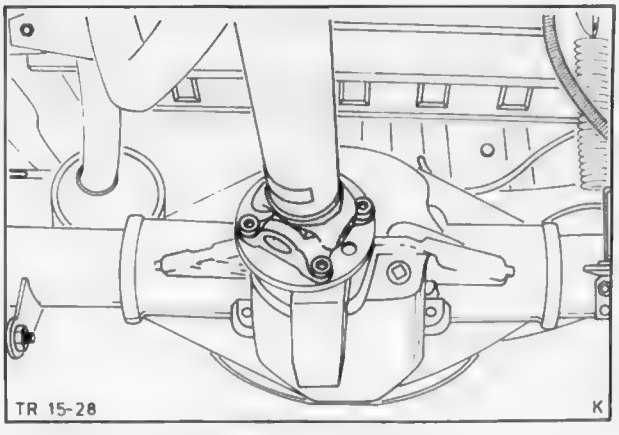


Fig. 134. Attach driveshaft to rear axle flange

15 302 SEAL – DRIVE PINION – REPLACE

Special Service Tools Required:

Universal flange holding wrench	15–030
Drive pinion oil seal installer	15–047B
Drive pinion oil seal remover	15–048

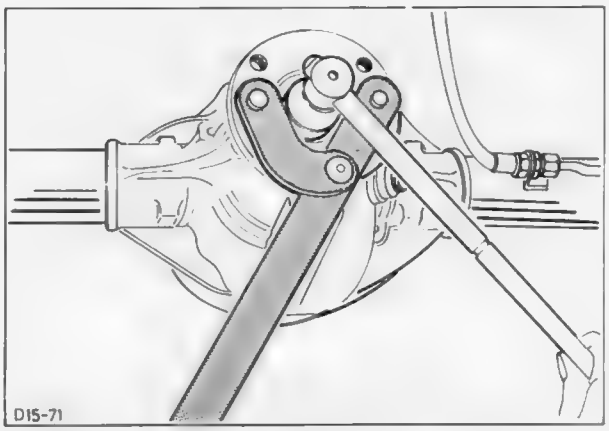


Fig. 135. Hold flange with special tool no. 15–030 and unscrew nut

To Remove

1. Disconnect driveshaft from rear axle flange (4 bolts).
2. Hold flange with Special Tool and unscrew nut, Fig. 135.
3. Remove flange with Standard Tool.

   NOTE: Catch oil spills.
4. Remove oil seal with Special Tool, Fig. 136.

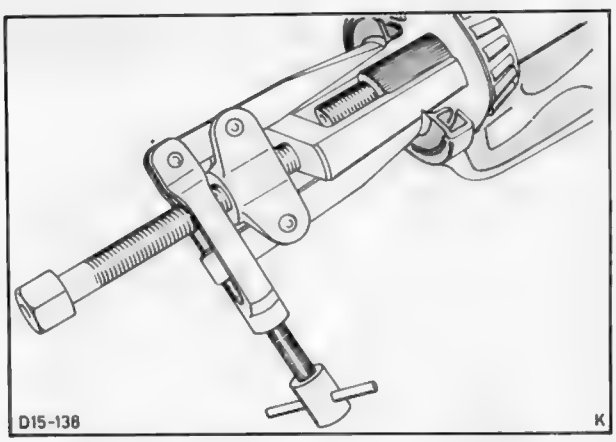


Fig. 136. Remove oil seal with special tool no. 15–048

To Install

5. Install oil seal with Special Tool. Lightly grease seal between the two lips, Fig. 137.

   NOTE: Grease on seal when supplied must not be removed.

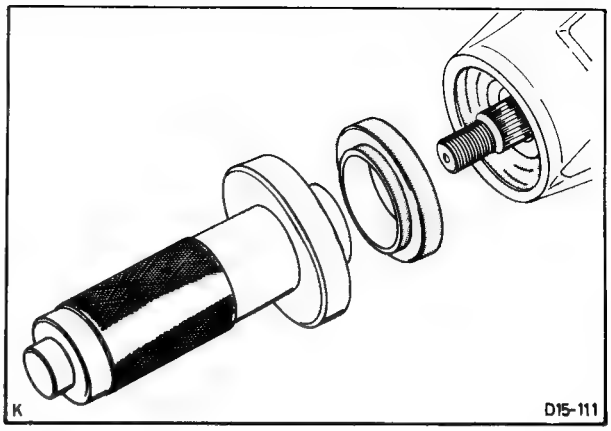


Fig. 137. Install oil seal with special tool no. 15–047B

6. Fit flange, hold with Special Tool, screw on new nut and tighten to specified torque.

   NOTE: Use new nut.

7. Attach driveshaft to rear axle flange, Fig. 138.
8. Check oil level and top up if necessary.

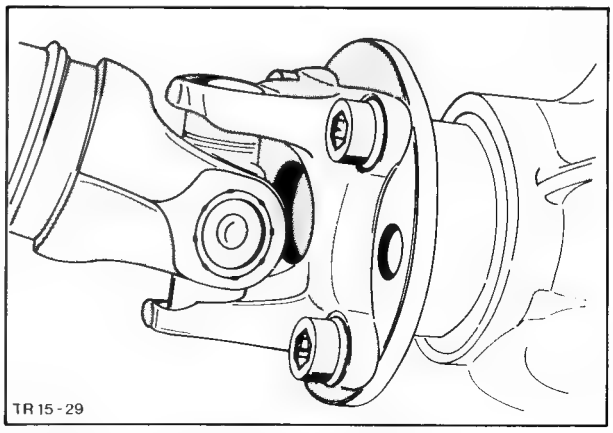


Fig. 138. Attach driveshaft to rear axle flange

15 514 DRIVESHAFT ASSEMBLY – REMOVE AND INSTALL

Special Service Tools Required: None

To Remove

1. Disconnect driveshaft from rear axle flange (4 bolts), Fig. 139.
2. Disconnect centre bearing from floor pan (2 bolts).

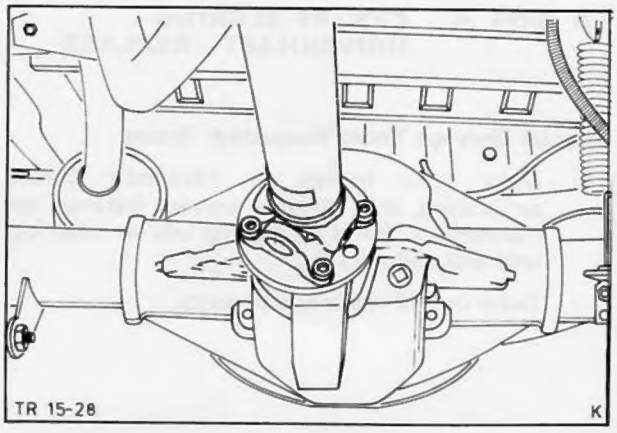


Fig. 139. Detach driveshaft from rear axle flange

3. Draw driveshaft out of gearbox extension housing and insert old driveshaft stub or suitable plastic cap in extension housing, Fig. 140.

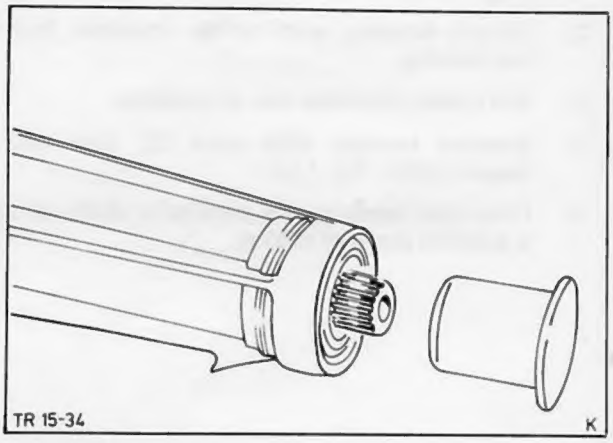


Fig. 140. Protective cap for gearbox mainshaft

To Install

4. Remove cap or driveshaft stub and insert driveshaft into extension housing.
5. Attach driveshaft to rear axle flange, Fig. 141.
6. Bolt centre bearing free of strain to floor pan, Fig. 141.
7. Check transmission oil level and top up if necessary.

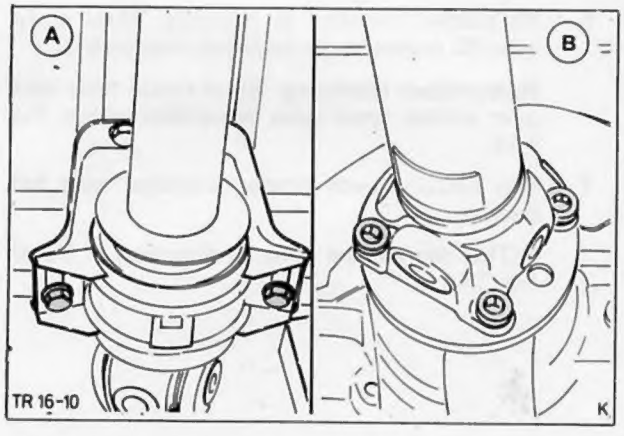


Fig. 141. A – Centre bearing attached to floor pan
B – Driveshaft attached to drive pinion flange

15 564 4 CENTRE BEARING – DRIVESHAFT – REPLACE

Special Service Tools Required: None

1. Mark both halves of driveshaft before separating, this ensures correct balance on reassembly. Bend up locking tab on retaining bolt and undo bolt.

   Draw out 'U' retainer sideways.

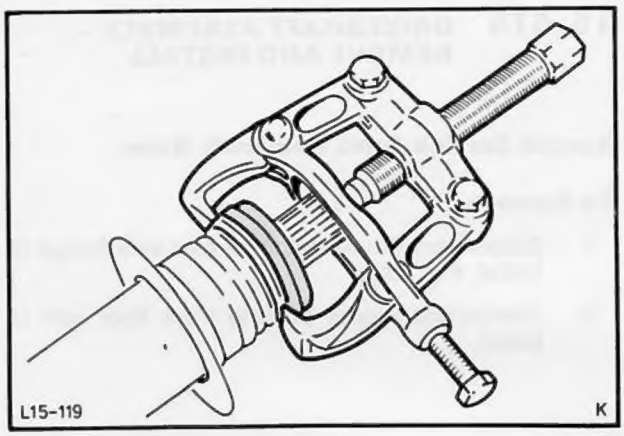


Fig. 142. Remove ball bearing with protective cap

2. Detach housing with rubber insulator from ball bearing.
3. Pull rubber insulator out of housing.
4. Remove bearing with caps (2). Use two-legged puller, Fig. 142.
5. Drive ball bearing with caps onto shaft using a suitable piece of tubing.

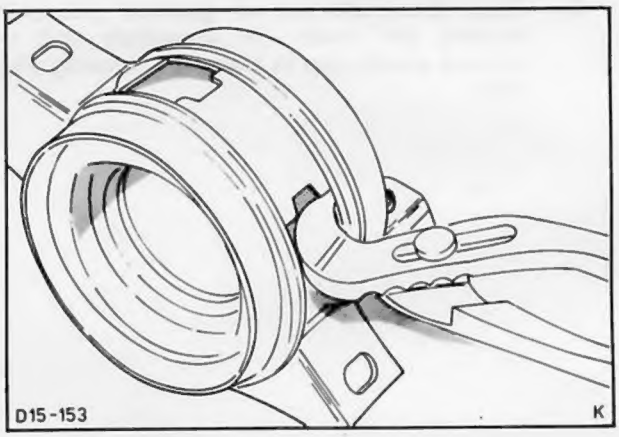


Fig. 143. Bend metal tabs (6) over rubber bead

6. Fit rubber insulator in housing. Bend metal tabs (6) outwards to facilitate insertion.

   Remember marking. Bend metal tabs back over rubber bead with adjustable pliers, Fig. 143.
7. Slip housing with rubber insulator over ball bearing.

   NOTE: Mark must point in direction of travel, Fig. 144.

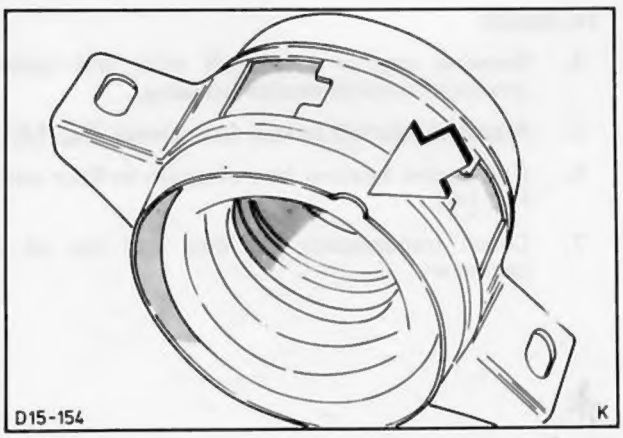


Fig. 144. Housing mark (direction of travel)

8. Insert bolt with locking plate into front half of driveshaft until U-retainer can just be slid into place, Fig. 145.
9. Assemble driveshaft halves, **lining marks up as before.**

   Insert 'U' retainer with pin facing splining, tighten bolt and secure with lock plate.

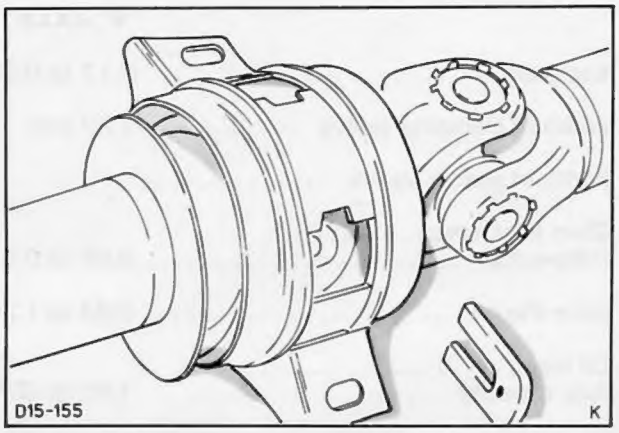


Fig. 145. Insert 'U' retainer

15 621 REAR SPRING ASSEMBLY – REMOVE AND INSTALL

Special Service Tools Required: None

To Remove

1. Jack-up vehicle and fit stands at rear, remove spring 'U' bolts (4 nuts).
2. Detach spring hanger at rear, Fig. 146.
3. Detach spring bolts at front end and take out rear spring assembly.

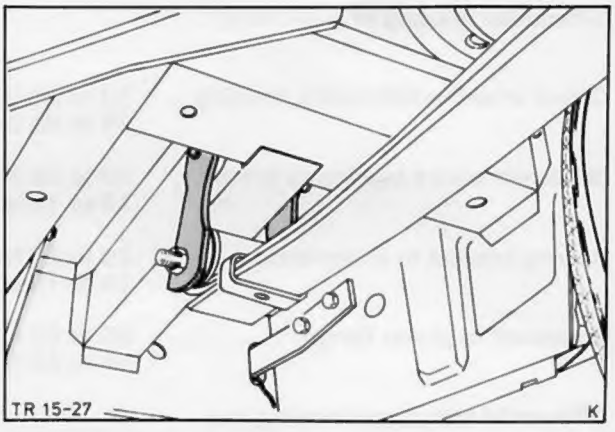


Fig. 146. Detach rear spring hanger

To Install

4. Insert rear spring assembly, and fit bolts at front.
5. Fit spring hanger at rear end.
6. Attach spring 'U' bolts, centering axle with centering bolt, and lower vehicle, Fig. 147.

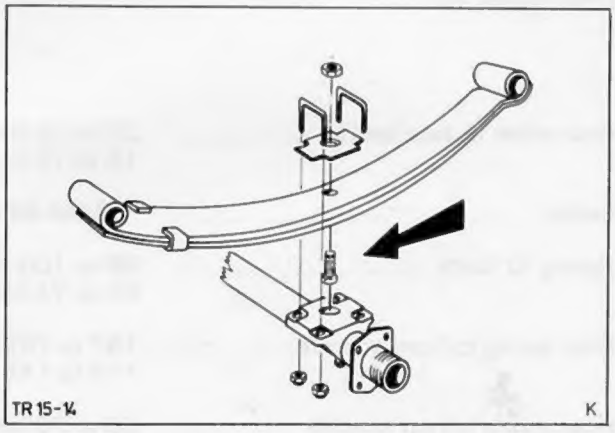


Fig. 147. Centre axle with centering bolt

TECHNICAL DATA: For rear axle ratios see REAR AXLE USAGE CHART on page 3.

	'F' AXLE	'G' AXLE	'H' AXLE
Backlash	0,12 to 0,22 mm	0,12 to 0,22 mm	0,10 to 0,20 mm
Width of clamping sleeve	11,7 mm	10,30 to 11,95 mm	
Width of spacer sleeve			52,45 mm
Shim thickness: Differential	0,06 to 0,5		
Drive Pinion	0,84 to 1,25 mm	1,72 to 2,25 mm	3,73 to 0,13 mm
Oil type	SRM 2C 9102 A		
Axle capacity	1,40 ltr (2,45 pt.)	1,72 ltr (3,25 pt.)	2,70 ltr (4,75 pt.)

TIGHTENING TORQUES	'F' AXLE	'G' AXLE	'H' AXLE
Bearing cap to axle casing	60 to 70 Nm 44 to 52 lb.ft.	99 to 118 Nm 74 to 87 lb.ft.	95 to 109 Nm 72 to 81 lb.ft.
Differential housing to axle casing			54 to 61 Nm 39 to 44 lb.ft.
Crown wheel to differential housing	79 to 86 Nm 58 to 63 lb.ft.	99 to 118 Nm 74 to 87 lb.ft.	68 to 75 Nm 50 to 55 lb.ft.
Driveshaft centre bearing to bracket	20 to 25 Nm 15 to 18 lb.ft.		
Bearing bracket to under-body	20 to 25 Nm 15 to 18 lb.ft.		
Driveshaft to pinion flange	60 to 65 Nm 44 to 49 lb.ft.		
Differential housing to bearing cap lock bolts		15 to 21 Nm 12 to 15 lb.ft.	17 to 21 Nm 13 to 15 lb.ft.
Wheel hub nut	200 to 240 Nm 148 to 184 lb.ft.	(locknut) 70 Nm 52 lb.ft.	
Drive pinion nut		99 to 118 Nm 74 to 87 lb.ft.	to give running torque of 2,6 to 3,2 Nm 1,5 to 2 lb.ft. (excluding oil seal)
Rear cover to axle casing	20 to 25 Nm 15 to 18 lb.ft.	20 to 25 Nm 15 to 18 lb.ft.	
Sealer	SDM-49-9105-A Loctite typ 275		
Spring 'U' bolts	88 to 100 Nm 63 to 74 lb.ft.	120 to 130 Nm 96 to 104 lb.ft.	88 to 100 Nm 63 to 74 lb.ft.
Rear spring to front shackle	157 to 196 Nm 116 to 146 lb.ft.		
Rear spring to rear shackle	60 to 70 Nm 44 to 52 lb.ft.	(120 only 60 to 70 Nm 44 to 52 lb.ft.) 157 to 196 Nm 116 to 146 lb.ft.	(100 L only 157 to 196 Nm 116 to 146 lb.ft.) 60 to 70 Nm 44 to 52 lb.ft.